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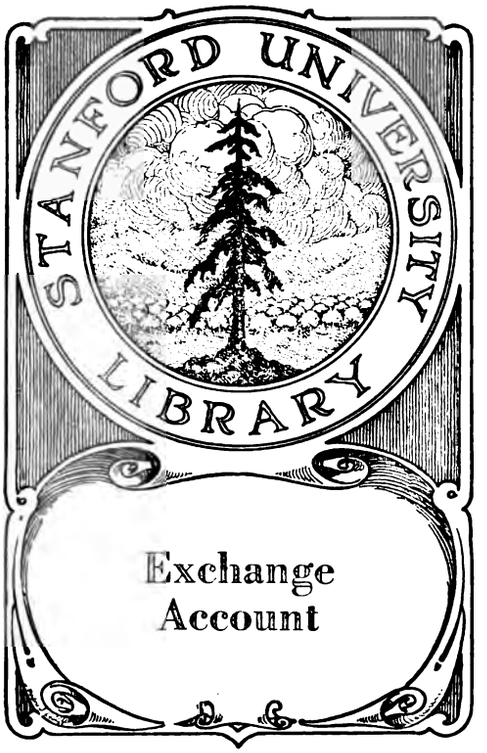

MEMOIRS OF THE GRAY HERBARIUM
OF HARVARD UNIVERSITY

I

A MONOGRAPH OF THE GENUS BRICKELLIA

BY

BENJAMIN LINCOLN ROBINSON

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INTRODUCTION

History. Relationship. General Features

In its present need of revision the Genus *Brickellia* presents no unusual condition among the larger genera of the *Compositae*. Exceedingly few of these groups have at any time received monographic treatment. Indeed, in a surprisingly large number of cases the nearest approach to such revision consists in the preliminary assembling of the then known species in De Candolle's Prodromus, v.–vii. (1836–8), a work in which no detailed keys were attempted. Since that time most genera in this great family have grown to twice or three times their extent, but the attention devoted to them has been in almost all instances confined to the description of newly recognized species or to floristic treatments in which the limits and point of view have been geographic rather than monographic.

However, *Brickellia* has been more fortunate than many of the other large genera of the *Compositae*, for in 1852 Dr. Asa Gray (Pl. Wright. i. 84–6) published a serviceable recension of the 32 species known to him and provided them with a partial running key. Subsequently, in 1884 (Syn. Fl. i. pt. 2, 104–8) he gave the species occurring within the United States a clear and excellent floristic treatment. These were thirty in number, as then delimited. Hemsley in 1881 (Biol. Cent.-Am. Bot. ii. 106–7) gave a useful enumeration of 35 Mexican and Central American species with carefully compiled synonymy, ranges, and exsiccatae. During the last three decades many species have been added to the genus, but it has not otherwise received much attention in print.

The genus is a natural one, belonging to the *Eupatorieae-Kuhniinae*, and in this subtribe may be readily recognized by its habitually 10-ribbed achenes, much imbricated involucre with striated scales, its normally calvous disk, and its simple or merely barbellate (never strongly plumose) pappus of many capillary bristles. At a single point (in the species *B. Fendleri* to be discussed later) the usually well marked distinction between the 10-ribbed achenes of *Brickellia* and the 5-angled achenes of *Eupatorium* breaks down completely and it is necessary to infer the affinities of the species in question from habital traits of minor importance. In a single Brazilian species, doubtfully referred to *Brickellia*, a few pales occur to-

ward the edge of the disk. In general, however, the genus is pretty readily delimited from all others. Several small genera from habital similarity are often confused with *Brickellia* in herbaria, yet are readily separated on the examination of their technical characters. Thus *Carminatia*, though possessing rather closely the aspect of a *Brickellia*, has 5-angled achenes and a decidedly plumose pappus; *Kuhnia* has more equal and less strongly imbricated involucral scales and a clearly plumose pappus; and *Barroetea*, in habit exceedingly close to *Brickellia*, may be readily distinguished by its compressed achenes.

Brickellia is exclusively an American genus and no species of the Old World appear at any time to have been referred to it. The genus ranges from the southern border of British Columbia through western North America, Mexico, Central America, and sparingly to Bolivia and eastern Brazil. Only three species are as yet known from South America. Of these one is the widely distributed annual *B. diffusa*, and the other two are somewhat shrubby Brazilian xerophytes. In North America only one species occurs east of the Mississippi River, namely *B. cordifolia* which is confined to an isolated and rather restricted range in the Gulf States. Only the annual *B. diffusa* has thus far been found in the West Indies.

The species are chiefly calciphile and occur for the most part in mountain ravines. Many are in varying degree xerophytic and some are distinctly plants of the desert. A few are at times riparian but none is hydrophytic or even strongly palustrine and with the possible exception of the Lower Californian *B. glabrata* none appears to be maritime. Except perhaps the annual *B. diffusa*, widely distributed in the warmer parts of America, none exhibits any ability to spread as a weed, thrive in ruderal habitats, or become established beyond the range where indigenous.

The genus has exceedingly little claim to economic importance. A few of the more xerophytic species are mildly aromatic. A few, notably *B. pulcherrima* and *B. hymenochlaena*, from their brightly colored or massed flowers, or on account of their graceful habit or good foliage, seem to suggest possible value in horticulture. *B. glabrata* and *B. spinulosa* are said to be browsed by cattle. For a genus of more than ninety species and many well marked varieties *Brickellia* is singularly rare in cultivation even in the larger botanical gardens.

Generic Nomenclature

While not without some complications, the generic nomenclature of *Brickellia* presents no serious difficulties. Of the six names which have been proposed for the genus it is clear that the earliest was *Coleosanthus* Cass., a name, which, after long

lapse, was revived by Kuntze in 1891 and is still accepted by those Americans who follow the American Rules. Unfortunately Cassini was not entirely clear in defining the genus and himself associated with it material which was not congeneric. It happened, therefore, that it was under the name *Brickellia* of Elliott that the genus was first correctly understood and it was under that name that a large portion of its species were first characterized. For these reasons and to avoid needless and inconvenient change in established usage the name *Brickellia* was included in the list of nomina conservanda, which were validated at the Botanical Congress of Vienna in 1905 and incorporated in the International Rules of Botanical Nomenclature.

The remaining four names, *Rosalesia* La Llav., *Bulbostylis & Clavigera* DC., and *Ismaria* Raf. (the last a mere renaming of *Rosalesia*), all drop into synonymy whatever rules are followed. It has been found possible, however, in the present treatment to retain *Coleosanthus*, *Bulbostylis*, and *Clavigera* as appropriate sectional and subsectional designations.

An earlier homonym, *Brickellia* Raf. Med. Rep. hex. 2, v. 353 (1808), only an arbitrary, carelessly performed, and wholly unjustifiable renaming of *Ipomopsis* Michx. Fl. Bor.-Am. i. 141 (1803) — a group now treated as *Gilia*, sect. *Ipomopsis* (Michx.) Benth. Bot. Reg. xix. t. 1622 (1833) — has no possible validity under any code of nomenclature and therefore need cause no difficulty. See Robinson, Rhodora, xviii. 229 (1916).

Division into Sections

One of the chief difficulties encountered in the preparation of the present paper has been to find any adequate basis for the primary division of the genus into definable sections. No one in the past appears to have discovered any effective planes of cleavage within the genus. De Candolle's two genera *Clavigera* and *Bulbostylis* fail to stand satisfactorily, even as subgenera, on the characters which he assigned to them.

Dr. Gray, in treating thirty North American species in the Synoptical Flora, made his main division on the number of florets, placing in the first group species with 35–50-flowered heads and in the second those with 9–25-flowered heads. This is very unsatisfactory, even as applied to the North American species, and becomes even more unworkable when tried on the numerous Mexican and Central American members of the genus. Indeed, Dr. Gray must have made his distinction of groups hurriedly, for in the one with " heads 9–25-flowered " he includes among other

species *B. longifolia* and *B. multiflora* concerning which he says "heads 3–5-flowered."

Considerable experimentation and very numerous dissections have led the writer to the belief that subgenera in the definite sense in which they may be recognized in such neighboring genera as *Piqueria* or *Ageratum* do not exist in *Brickellia*, with the possible exception of the two endemic Brazilian species, which stand somewhat isolated from each other as well as from the other members of the genus.

As to the number of florets in the head, it has been found very variable in certain species, as for instance in *B. grandiflora* and *B. veronicaefolia*, especially in var. *petrophila* of the latter species, yet in most cases it appears to be fairly constant, say within the limits of 5 to 20 per cent. While the number of florets, being subject to these variations, is not alone a satisfactory character for the primary division of the genus, nevertheless, when combined with a variety of other characters, it is a useful feature for classification. By means of such a combination the genus may be divided into several series which may best be treated as sections and subsections rather than as subgenera.

While these proposed groups are with little doubt natural in the sense that each contains only species pretty closely related to each other, it must be frankly confessed that the boundaries between the groups are in some instances rather artificial. This is particularly the case in the separation of Sect. *Bulbostylis* from Sect. *Eubrickellia*, and to avoid errors of determination which might otherwise arise, certain species have been reciprocally introduced into the keys of both sections.

Features and their Diagnostic Value

Duration and habit. — Only one species of *Brickellia*, namely *B. diffusa*, is definitely known to be annual. A second, *B. filipes* from southern Mexico, as yet imperfectly known from specimens not showing the base, so closely simulates *B. diffusa* in its slender habit, diffuse inflorescence, and slender heads that it is inferred to be also an annual. The remaining eighty-nine species are perennial herbs, suffrutescent plants, or shrubs. The transition, however, between the truly herbaceous species and those in varying degree ligneous is so gradual as to preclude much use of this distinction in defining or delimiting groups.

Root, rootstock, and caudex. — The root is prevailingly of slender fibres, but in *B. grandiflora* it is of one or more elongated soft-woody fusiform-thickened fibres penetrating to a considerable depth. Short horizontal tuberous-thickened rootstocks

rich in starchy matter occur in *B. hymenochlaena* and *B. monocephala*. Branched and somewhat lignescent caudices are frequent in the genus, but slender and elongated rootstocks, runners, or offsets do not appear to occur in the group.

Stem. — The main aërial axes, which may be solitary or several, are for the most part erect or slightly decumbent. None of the species is prostrate, trailing, or even strongly procumbent. None shows any tendency toward the climbing habit so prevalent in the neighboring genus *Mikania*. The stem is sometimes simple (*B. simplex, B. hymenochlaena,* etc.) but more commonly branched at least toward the summit. It is usually terete, sometimes moderately ribbed, often maculate. The branching is either opposite or alternate, usually ascending or (in *B. Brandegei* and *B. macromera*) divaricate. Induration of the branchlets occurs to a certain extent in a few xerophytic species, such as *B. frutescens*, but scarcely to spine-like pungency.

Leaf-arrangement. — The leaves are alternate or opposite or both. In a single species (*B. amblyolepis*) the cauline are verticillate. However, notwithstanding the variety of leaf-arrangement within the genus the feature is very disappointing as a diagnostic character in the separation of groups. For some species with leaves quite regularly opposite toward the base have them alternate above, while others curiously exhibit the opposite tendency since although their stem-leaves are prevailingly alternate, the rameal (especially the first one to three pairs on each secondary axis) are apt to be opposite. Striking variations occur in plants otherwise seemingly identical; and in general it is to be inferred that in this genus leaf-arrangement is in a somewhat plastic state and much less definitely fixed as a character than in most genera of the *Compositae*.

Petiole. — In some species the leaves are rather closely sessile. In a few cases they are amplexicaul, but they are rarely decurrent and then only as inconspicuous lines or ridges not as wings on the stem. In most species, however, there is a distinct petiole, often long and slender. In default of better characters the presence and even the length of the petiole has to some extent been employed in the separation of groups.

Leaf-blade. — The blade presents a considerable variety of forms within the genus, from almost acicular in the xerophytic Brasilian perennials to suborbicular or reniform in several species. After many efforts to secure groupings based on more constant or fundamental traits, it has been found best to make considerable use of leaf-form in the grouping of the species, especially in the subsections of Sect. *Bulbostylis*. This character, while seemingly superficial, has here proved rather

better than anticipated, and it is believed that the distinctions between leaves of the linear-oblong and elliptic type on the one hand and ovate or lanceolate on the other, or between those of a generally triangular-hastate contour and those (usually smaller) which tend to be suborbicular or reniform, will be readily apparent and can be clearly followed, especially with the aid of the accompanying figures. On the contrary the marginal toothing, to which certain authors have attributed importance, as for instance in the separation of supposed segregates of *B. grandiflora*, has been found exceedingly untrustworthy; serrate, dentate, and crenate forms passing into each other by imperceptible gradations; and, what is worse, sometimes occurring in different leaves on the same individual. More significant for purposes of classification is the texture of the leaf. In this, at least four conditions are pretty readily distinguishable and, within individual species, for the most part fairly constant. 1. A softly membranaceous texture, which is rather common in the genus. 2. A pliantly coriaceous or subcoriaceous character (often accompanied by copious soft indumentum), a texture rather frequent, as for instance in *B. secundiflora*, *B. pendula*, *B. lancifolia*, etc. This shows intra-specific variation in a few cases, passing in *B. pacayensis* and *B. Parryi* to a thinner and submembranaceous texture. 3. A somewhat chartaceous character, in which thinness is combined with a decidedly firm stiffish texture. This is rare in the genus, but occurs noticeably in *B. Seemanni*. 4. A thick and firmly coriaceous nature, found in a few decidedly xerophytic species, chiefly *B. baccharidea*, *B. atractyloides*, and *B. arguta*. The leaves are almost universally 3-ribbed. The divergence of the ribs commonly begins at the base, but occasionally somewhat above the base, though this difference has more plausibility than actual worth in classification, since it proves rather variable in degree in plants otherwise convincingly identical. It has, however, been found a useful adjunct-character in distinguishing some nearly related species, as for instance *B. nutans* and *B. orizabensis*. More or less glandular punctation in the leaves is also normal throughout the genus though occasionally obscure. The density of the glands has in some instances been found diagnostic, thus in *B. californica* the glands are considerably less crowded than in the nearly related *B. desertorum*.

Inflorescence. — The heads are most frequently borne in a leafy-bracted panicle, but there is great variety in the inflorescence. In *B. monocephala* so far as yet known there is only one head, which is terminal and strongly nodding. *B. simplex* was described from slender simple specimens which in the same manner bore single heads, but subsequently collected specimens have in this species shown this to be by no means constant, for several heads are commonly present and are arranged in a

loose raceme. In *B. corymbosa* the heads are truly corymbose, a type of inflorescence exceptional in the genus. In the nearly related *B. scoparia* the inflorescence is misleadingly variable and may merit more detailed study than the material now available permits. Rather wide variation in the density of the inflorescence occurs, notably in *B. grandiflora* and in *B. pacayensis*, but although conspicuous in their extremes the resulting forms cannot be satisfactorily treated even as variaties.

Pubescence. — No other feature offers in *Brickellia* so many plausible grounds for distinctions as does the pubescence, particularly the presence or absence of double pubescence, partly glandular and partly non-glandular. Yet these characters, on further examination and especially after the study of much material, nearly always break down hopelessly and are seen to be subject to complete intergradation; and what is more significant appear in many cases to be so readily changed (marked variation occasionally being found upon the different branches of the same stem) as to render highly artificial any distinctions based upon them. As these characters of pubescence are easily seen, convenient to state, and on first inspection convincing, many distinctions have been based upon them in the past. These in the present work have been given for the most part only varietal or in some cases only formal rating. Thus *B. petrophila* is reduced to a variety of the earlier *B. veronicaefolia* from which it scarcely differs except in pubescence and in that not without occasional intergradation. With regret *B. linifolia* is reduced to a variety of *B. oblongifolia*, from which it differs scarcely at all except in the non-glandular nature of its pubescence, particularly that of its achenes, a distinction by no means absolute and showing at times complete transition. Similarly intergrading pairs of glandular and non-glandular plants are to be seen in the cases of *B. secundiflora* and its var. *nepetaefolia*, and of *B. adenocarpa* and its var. *glandulipes*, also elsewhere in the genus. In a very few instances, however, characters of pubescence have been given a certain weight in the separation of species in the present paper. Thus *B. glabrata* is separated from *B. brachiata* largely on account of the complete absence of pubescence, yet it is to be remarked that there are other concomitant minor characters in this case. *B. amplexicaulis* is still separated from *B. betonicaefolia* chiefly on account of it copious glandular pubescence, a character which in this particular case has not been observed to break down or exhibit intergradation. The group in which pubescence plays the most important rôle in classification is the one here treated as Subsect. *Microphyllae*. In it there are four nearly related and habitally similar plants each exhibiting a different type of pubescence. On careful study it appears that these differences of pubescence are accompanied by a few minor concomitant

differences in such characters as the number of florets, length and attitude of the lateral branches, size of leaves, number of bracts, etc. More significant is the fact that the geographic ranges of these four plants are widely different and scarcely overlap. Under these circumstances it seems best to give the pubescence at this point greater classificatory weight than elsewhere in the genus, though it must be freely admitted that until further collecting over a wide area has been accomplished there can be no final decision as to the taxonomic value of these species in Subsect. *Microphyllae*.

Involucre. — As is quite general in the *Compositae* the involucre here offers highly important characters in the specific classification. These are as usual to be found for the most part in the relative length, varying acuteness, and differing texture, color, and pubescence of the scales. To some extent it has been found that the actual number of scales is diagnostic. This is a character which is apt to be somewhat proportional to the number of florets and may be employed in the same manner and with the same understanding that variations of 15 to 20 per cent are to be expected. Most attempts to use the number of ribs or striations on the scales as a taxonomic character have failed, yet in a few cases this feature has given good results and has proved a helpful adjunct-character. In one respect the involucre shows surprising intra-specific variability, namely in the degree to which the scales may become herbaceous and squarrose at the tip. This variation becomes especially puzzling in the otherwise perplexing Subsect. *Coleosanthus*, where in several species (including the real *Coleosanthus squarrosus* of Cassini) the scales are sometimes all appressed and sometimes in varying degree squarrose. In certain instances the resulting forms if seen only in their extremes could hardly be regarded as conspecific, yet intergradation is clear and it is particularly significant that parallel variation occurs in several species. It is for these reasons that *B. squarrosa* Robinson & Seaton is now confidently treated as a variety of *B. pendula* although at first sight the involucre seems to give ample distinction (figs. 64, 65).

Corolla. — In *Brickellia* the corolla shows much less diversity than in the related large genera *Eupatorium* and *Mikania*, being almost uniformly slender and cylindric without perceptible differentiation into a throat and a proper tube. In a very few species there are exceptions to this rule, notably in *B. monocephala* in which the corolla has a long cylindrical throat and a short but distinct proper tube. In *B. cordifolia* and a few other species the corolla is slightly and gradually enlarged upward. More significant, however, are the teeth of the limb, which although in most species very short, sub-erect, and triangular-ovate, become in Sect. *Steviastrum*

longer and more spreading. In the specific descriptions the information which can be given regarding the color of the corolla is in many instances disappointingly slight. The color is usually transitory, being commonly lost at or soon after drying, ochroleucous, roseate, and purplish tints all tending to turn to shades of yellowish brown, so that one must depend upon collectors' notes as to the color and these are exceedingly few. Even when the " color of the flower " is mentioned on a field-label there is often much room for suspicion that the color recorded is not that of the corollas but the result of a composite impression derived quite as much from the conspicuously protruding style-branches and striated often colored involucral scales. The examination of numerous dried specimens of recent date leads to the belief that the color of the corollas is subject to variation not merely in the same species but even in the same individual or in parts of the same corolla. By way of generalization it may be said of most species of *Brickellia* that there is a tendency to purplish coloration. This may reach a deep crimson, but is usually restricted to a mere roseate tinge near the limb of the corollas. On the other hand the corollas may be pure white, ochroleucous, or a pale greenish yellow. Collectors who have the opportunity to observe the species of this genus in the wild are urged to make careful notes on the actual color of the corollas.

Androecium. — The stamens have failed to yield diagnostic features, though their degree of cohesion and relative lengths of thecae and apical appendage show noticeable differences in certain species. However, in the experience of the writer, it is difficult to be quite sure in how far these apparent differences may be the result of varying degrees of maturity and in any event they are rather obscure and correspondingly inconvenient for classificatory purposes in this group.

Style-branches. — In a single case the style-branches have proved decidedly helpful in supplying inter-specific distinctions, namely between the annual *B. diffusa*, in which they are filiform, and the habitally similar *B. filipes*, in which they are clavellate. Elsewhere the differences observed have been confined to color, length, degree of exsertion, and degree of clavellate enlargement, and have yielded few characters of taxonomic significance. The same is true of the universally present enlargement at the base of the style. In the different species, as will be evident from the illustrations, this structure varies from broadly ovoid or subglobose to drum-shaped. It is sometimes essentially smooth and in other cases in varying degrees covered by erect short bristles. Possibly these differences may on further study prove helpful in the grouping of the species into sections, but attempts in this direction have not thus far led to consistent or convincing results.

Achene. — In form the achene is tolerably constant throughout the genus, being prevailingly columnar, ten-ribbed, and slightly narrowed downward. It is provided at base with a smooth rounded callous appendage of different texture and usually paler color. The body of the achene is sometimes essentially glabrous but more commonly pubescent; and the pubescence, differing much in quantity and nature, yields many characters of classificatory value. But in the case of the achenes as on the pedicels and involucral scales the presence of sessile or stipitate glands proved too inconstant to be regarded as a character of more than varietal importance. The ribs of the achenes are not constantly ten. There are sometimes only eight or nine. On the other hand, in *B. veronicaefolia* the intervals between the ten main ribs are sometimes rounded up into secondary longitudinal ridges, giving the achenes (especially when dried) an appearance of being 20-ribbed. This, however, is obviously a minor character of variable extent and accompanied by no other differences suggesting generic distinctness. Much more awkward in relation to generic classification is the more or less complete obsolescence of five of the ten principal ribs in *B. Fendleri* for it tends to break down the most important technical distinction between *Brickellia* with its normally 10-ribbed achenes and the great and already unwieldy genus *Eupatorium*, in which the achenes are normally 5-angled. However, it would certainly be exceedingly unwise to reduce a genus like *Brickellia*, long maintained as a useful and generally recognizable group, and merge it with *Eupatorium*, even though the chief distinction breaks down at a single point. Nor is it feasible in this case to establish a small intermediate genus, since such a group would lack clear or satisfactory characters. Dr. Gray was first inclined to associate this dubious species with *Brickellia*, but in the preparation of the Synoptical Flora he referred the plant in question to *Eupatorium* as *E. Fendleri*. To judge from the species now known of both genera this was unwise, for the doubtful species when placed in *Eupatorium* becomes somewhat isolated, while if restored to *Brickellia* it may be associated with species of closely similar habit, involucre, etc., strongly suggesting that here is its real affinity. There is similar uncertainty as to the correct generic position of the Brazilian *B. coridifolia* since its achenes are thus far known only in a state too immature to make it clear whether they are to be classed as 5-angled or 10-ribbed. The species, pending further knowledge of its achenes, is provisionally placed in *Brickellia* largely on account of its close habital similarity with *B. brasiliensis*.

Pappus. — Systematic effort has been made to determine whether the number of pappus-bristles would yield differences of classificatory value, and here the results

have been fairly satisfactory. The number varies in different species rather widely, from about 10 to more than 80. When the number of the bristles is taken in connection with the length, texture, and degree of barbing, the pappus as a whole furnishes a considerable number of distinctly useful traits, and except as to color appears to be remarkably constant within the species. In color there seems to be rather wide variation in certain species, notably in *B. californica*, which leads to the conclusion that it may be subject to change from varying degrees of exposure, local conditions, methods of drying, age of the specimen, etc. — at all events that its use in taxonomy should in this group not be undertaken without particular caution.

Disk. — Some use has been made of the presence or absence of hair on the disk, but this feature is not very satisfactory, since the character becomes in many species so gradually obsolete that examination even with rather high-powered lenses is apt to leave uncertainty whether a slight vestige of puberulence justifies the expression " disk hairy " or is to be regarded as negligible.

Specific Ranges

Among the species recognized in this paper only four can be said to have broad ranges. These are the tropical *B. diffusa* (distributed from Mexico and the West Indies to Brazil and Bolivia) and the North American *B. grandiflora*, *B. californica* and *B. oblongifolia* (including its var. *linifolia*), which are all rather widely distributed in the western part of the United States. All the other species have pretty definite and most of them rather restricted ranges. *B. cordifolia* is noteworthy as being isolated from its congeners. *B. microphylla*, ranging in the drier parts of the Sierras from Oregon to eastern central California, reappears, without apparent change of character, on Cedros Island off Lower California.

Fixity of Species

As to fixity of character, it may be said that of the 91 species here recognized at least 80 are unquestionably distinct. The remainder show the following approaches to other species though actual intergradation has not been successfully proved.

B. Knappiana is close to *B. multiflora*. Both are rare species as yet very sparingly represented in herbaria.

B. scabra and *B. Watsonii* are exceedingly close to each other and to *B. microphylla*, though the three occur in distinct or scarcely overlapping ranges.

B. lancifolia is nearly related to *B. pendula*, differing somewhat in leaf-contour but chiefly in its less acute involucral scales.

B. reticulata, *B. Kellermanii*, and *B. venosa* are all as to technical characters very close to *B. oliganthes*, but are thus far capable of fairly definite differentiation, which, however, may perhaps break down when a larger series of specimens is available.

B. odontophylla, except for its smaller, more numerous, and fewer-flowered heads, closely simulates *B. simplex*. It is believed, however, that these species are in reality quite distinct.

B. glabrata differs from *B. brachiata* chiefly in leaf-texture and in the absence of pubescence.

B. Brandegei and *B. macromera*, two species of Lower California here proposed as new, are obviously very similar and closely related. Nevertheless, there are several minor differences as well as the rather important one of the inner involucral scales, and at least until intergradation can be demonstrated it will be necessary to treat these plants as separate species, a rank which it is believed they will continue to justify even when known from more copious material.

The group which at present involves the greatest difficulties in the satisfactory delimitation of species is the southern Mexican and Central American one which includes *B. squarrosa* (Cav.) Robinson. Here many forms have been examined, which, though not identical, differ by characters of a mostly trifling nature. To unite them all would be to create a vague aggregate composed obviously of dissimilar elements. To separate them, however, into many species would on the other hand involve the use of differential characters which ordinarily have very little weight. After experiments, both in the direction of finer splitting on the one hand and of greater reduction on the other, a treatment is here presented which is believed to offer adequate recognition of dissimilar tendencies, yet to permit a fair degree of clearness in keying. It is perhaps the best evidence of the practicality of this course that it has permitted a definite determination of nearly all the specimens examined, the exceptions being in most instances defective or immature.

In the group just mentioned (Subsect. *Coleosanthus*) some of the earliest species, notably those of Cassini, HBK., and Schrader were, as it now appears, misinterpreted by Dr. Gray. Consequently those very species to which in recent years a large part of the Mexican and Central American specimens have been referred must be redefined or in certain cases reduced, namely *B. Cavanillesii*, *B. secundiflora*, *B. pendula*, and *B. nutans*. In regard to these changes, it may be said that they have been made after personal examination of the types of a very high percentage of the

species of the genus. To reduce so far as possible the confusion and annoyance incident to the use of old names in unfamiliar senses, it has seemed best to cite exsiccatae very fully.

Intra-specific Variation

Only such varieties and forms are here maintained as have shown a fair degree of definiteness and have proved capable of clear statement. It is quite possible that in the two widely distributed and variable species of the western United States, *B. californica* and *B. grandiflora*, the material included without varietal or formal distinction may at first sight appear unduly varied; but the variations, caused largely by differing degrees of altitude and dryness of habitat, not only merge hopelessly when examined in copious material but exhibit independent variability of different characters, such as the size and texture of the leaves, sharpness of their dentation, length of petiole, looseness and denseness of inflorescence, amount of pubescence, etc., in a way to show that the different combinations of the (often conspicuous) characters have trifling and only formal value in classification. Some of these forms may doubtless prove useful and even be made fairly clear in floristic work on a limited area, but scarcely when a larger area is covered.

In certain cases it has been found necessary to reduce to varietal rank plants which have heretofore been regarded as independent species. This has always been done with regret and only after compelling evidence of intergradation has been observed. In this connection special mention may be made of *B. linifolia* D. C. Eaton. Much material of this plant has been studied and repeatedly re-examined in the hope of discovering some combination of characters by which it might be consistently kept separate from *B. oblongifolia*. In habit, foliage, pubescence, inflorescence, number of florets, pappus-bristles, and many minor characters the two are as it appears identical, or to be more exact, their individual variability is such that in none of these features has it been possible to detect any distinctions which would hold even tolerably. The only difference really worthy of note is that in the typical *B. oblongifolia* the puberulence of the achenes is chiefly if not wholly glandular, while in *B. linifolia* it is a short somewhat upwardly directed non-glandular hispidity. The ranges are in great part different, *B. oblongifolia* affecting cooler and more northern regions of greater humidity, while *B. linifolia* is rather widely distributed and frequent in exceedingly dry and open habitats from Colorado to southern California. Where the two meet, the single character separating these plants breaks down completely, individuals being frequent in which the achenes

have subsessile and stipitate glands together with the hispidity of a non-glandular character. Furthermore, the quantitative relation of the two sorts of hairs is variable in different individuals and at no point is it possible to make a sharp or definite separation. The two plants have been found much confused in herbaria and there is in the Gray Herbarium a manuscript note by Prof. L. F. Henderson expressing many years ago the opinion that the two could not be sharply separated. Prof. M. E. Jones has in a letter expressed a similar view, and Mr. T. S. Brandegee has communicated his recollection of the fact that Prof. D. C. Eaton expressed distrust of his own species. With this concurrent testimony on the part of experienced systematists familiar with the plants in the field as well as the herbarium, the writer has proceeded with greater confidence to give the two plants the relation of species and variety as better expressing their true taxonomic values.

Another instance in which it has seemed best to reduce a species which at first sight might be thought to have at least one rather striking character is that of *B. squarrosa* Robinson & Seaton. This was founded on a single individual, collected in the mountains of Michoacan by Mr. Pringle. At the time of its description it seemed in its conspicuously squarrose involucre so very different from the related and in nearly all other respects similar *B. pendula*, that there was no thought of their possible intergradation. However, in recent years much more material of *B. pendula* has been obtained and this has shown in varying degree a tendency to have more or less squarrose outer involucral scales. In the meantime no further material of *B. squarrosa* Robinson & Seaton has been discovered, rendering it not unlikely that it represents a somewhat exceptional extreme of the more common species. Careful search for supplementary characters for a more definite separation has not been very successful. The heads in *B. squarrosa* are slightly larger, but those of *B. pendula* show some variability in this regard, so that the trifling difference loses much of its slight significance. The pubescence on the pedicels is in *B. squarrosa* (under a lens) slightly shorter and a trifle denser, but here again the differences are those of degree and of a sort that will almost certainly break down hopelessly when the plants are examined in the light of more copious material. On the whole, it has seemed unwise to maintain as a distinct species a plant of which our knowledge rests upon a single specimen, of which the chief distinction appears to be merely an extreme development of a tendency quite clearly shown (though in less degree) by a closely related species of practically identical habit.

The reduction of this species to varietal rank happily permits the restoration of the homonym founded on the *Eupatorium squarrosum* of Cavanilles. In different

forms of the latter species, namely *B. squarrosa* (Cav.) Robinson, the involucral scales show to a rather remarkable extent a tendency to vary from appressed to conspicuously squarrose, a circumstance which strengthens the belief that a similar diversity in the case of *B. pendula* should not be rated as of more than varietal significance.

Species still obscure

In general, there has been a gratifying success in clearing up the less known species of the genus. Concerning one, however, adequate data are still lacking. This is the obscure Bolivian *B. paucidentata* of Klatt, founded on d'Orbigny's no. 558. This number has not been found in any of the collections examined. The *Compositae* of the late Dr. Klatt were purchased by the Gray Herbarium and include in nearly all instances at least fragments, tracings, or sketches of his types. Of this particular species, however, it has been thus far impossible to find any representation whatever.

It is by no means unlikely that Dr. Klatt detected some error in the placing of the plant and himself later referred it to some possibly remote genus. At all events, the fact that in the same paper he described his *B. Cumingii*, which later proved to be a *Chrysopsis*, and his *B. linearifolia*, which Dr. Gray found to have been a *Bigelowia*, suggests that the lost *B. paucidentata* may have had some similar fate. To judge from its meager characterization, in which the panicle is said to have been spiciform and the pappus rufous and plumose, as well as from the Bolivian range, which is much beyond the limits of any known *Brickellia* with the single exception of the widely distributed tropical annual species *B. diffusa*, it appears rather improbable that *B. paucidentata* is of the genus. The writer would be greatly indebted to anyone who may be able to discover the type-number, namely d'Orbigny's 558, if he would be so kind as to communicate further information concerning it, and particularly if he would send a small fragment, even a single floret, for investigation.

Keys

The keys, although the best that have resulted from a great deal of experimentation, will be found to leave much to be desired. It is to be remembered that they deal with a genus of the *Compositae* and particularly with a group in which there is great uniformity of floral structure and in fruit-characters, so that most of the distinctions have in consequence to be based upon features of a more variable and superficial nature — leaf-contour, texture, pubescence, degree of glandularity,

dimensions, etc. They must therefore be taken not as absolute but as pointing out traits normal to the species, although likely at almost any point to show exceptions, as when specimens are encountered which have grown in unusual conditions.

Illustration

Few genera of the size of *Brickellia* have received less effective illustration. For this reason it has seemed worth while to devote special attention to this matter and give as full illustration as possible to the present paper. In this enterprise the writer wishes to acknowledge his indebtedness to the artist, Mr. F. Schuyler Mathews, who with great patience as well as exceptional skill has succeeded in representing not merely the major features but many of the finer diagnostic characters, such as the varying pubescence, style-characters, and particularly the form, imbrication, striation, ciliation, and texture of the involucral scales — features very rarely brought out with sufficient clearness in illustrations of the *Compositae*. In this connection it must be pointed out with emphasis that, although it has been necessary to work entirely from dried material, the drawings of the involucres have in all cases been made from heads which had been restored to their natural form by boiling. Practically all the species of the genus on being dried tend to spread their involucral scales more or less widely, so that it is usual for a species which in nature has a subcylindric involucre to appear in a dried specimen to have one of turbinate or campanulate form. On being immersed a few seconds in boiling water the dried involucre regains its natural subcylindric shape, and it is in this state that it has seemed best to represent it. This fact should be carefully borne in mind when the drawings are compared with dried specimens. The difference may be readily seen by comparing Mr. Mathews's very accurate drawing of *B. scoparia* with the representation of the same species in Delessert's Icones, iv. t. 12, where the artist, obviously working from dried material, shows the involucral scales rather widely spread in post mortem attitude.

In the illustrations, it seemed best not to attempt habital sketches, which require an inordinate amount of space, but to restrict the drawings to such details as most clearly bring out the diagnostic features. Where not otherwise explained, these are a portion of the inflorescence $\times \frac{3}{4}$; a characteristic mature stem-leaf $\times \frac{3}{4}$; a head $\times 3$; a floret (with pappus partially removed to disclose the form of the corolla-tube) $\times 4\frac{1}{2}$; the style (omitting the prolonged simple columnar middle portion) $\times 6$. To these have been added in certain cases, where it is desirable for diagnostic purposes, a more enlarged bit of the stem to show pubescence, a portion of the branching

system to show angles of divergence, etc., or a portion of a much enlarged pappus-bristle to show the degree of barbing.

As stated above efforts to derive diagnostic characters from the stamens have not proved successful within the genus. The anthers, while not precisely alike in the different species, are apt to differ rather considerably and in a misleading way within the same species if not compared at precisely equivalent degrees of maturity, and so become an inconvenient feature for diagnostic use within the genus. It has therefore not seemed needful to include them in most of the figures.

In several instances the figures have been built up from small fragments, supplemented by a photograph or tracing. In the case of *B. subsessilis* the inflorescence is drawn from an old and withered one much past anthesis. The figure of *B. reticulata* is derived from a very poor and partially fogged photograph of the type in the De-Candollean Herbarium in Geneva. The details, however, have been definitely obtained from fragments of the type kindly lent by Dr. Casimir de Candolle for examination. Similarly the figure of *B. corymbosa* is drawn from a fairly clear photograph of the type in the same herbarium.

In all these cases special care has been taken to secure, notwithstanding unfavorable conditions, as great accuracy as possible and it is confidently believed that the resulting figures are entirely faithful to nature and will be found decidedly helpful in the recognition of the species.

Material Examined

The present treatment has been chiefly based upon an intensive study of the material in the Gray Herbarium, which includes a number of photographs of types in several of the leading herbaria in the Old World. The writer has been very greatly aided, however, by the privilege of borrowing the entire representation of *Brickellia* from the Missouri Botanical Garden, the herbarium of the University of California, and from the important private collections of Capt. John Donnell Smith of Baltimore and of Prof. Marcus E. Jones of Salt Lake City. Through the kindness of those in charge, he has also enjoyed every facility for examining the Brickellias in the herbaria of the New York Botanical Garden, Columbia University, the Philadelphia Academy of Natural Sciences, the United States National Museum, the Arnold Arboretum, and Brown University, with permission to borrow from each specimens requiring detailed study. Prof. C. F. Millspaugh has obligingly lent certain types and specimens of particular interest from the Field Museum in Chicago. Prof. Aven Nelson has similarly given valued aid by lending certain

specimens from the Rocky Mountain Herbarium of the University of Wyoming. Dr. Casimir de Candolle has generously lent characteristic fragments of *B. reticulata* and the problematic Peruvian *B. microphylla* (DC.) Hieron. from the Prodromus Herbarium. Mr. S. F. Blake, while studying at the Royal Gardens at Kew, obligingly made for the writer tracings and notes decidedly helpful in the precise identification of certain species, notably *B. Galeottii*, not hitherto understood on this side of the Atlantic, and through the kindness of the direction of the Gardens was permitted to include several characteristic fragments with his memoranda. As from these data *B. Galeottii* appeared to be a probable synonym of the older *B. veronicaefolia*, the writer referred the matter to Sir David Prain, Director of the Royal Gardens, with a request that the two be critically compared. This he obligingly had done, Mr. Hutchinson of the Kew Herbarium staff making the comparison and fully confirming the suspected identity. In response to inquiry Prof. L. Diels, Director of the Royal Botanical Garden of Berlin, has very generously supplied the writer with excellent photographs and characteristic fragments of what is regarded as authentic material of the obscure *Bulbostylis scorodoniaefolia* Kunth.

Mr. T. S. Brandegee has been so kind as to send for deposit in the Gray Herbarium several excellent specimens well illustrating his *B. peninsularis*; and Mr. F. V. Coville has similarly contributed ample material of his *B. desertorum*. Besides lending the *Brickellia* material from the valuable collections of which they have charge, Prof. H. M. Hall of the University of California and Prof. J. M. Greenman of the Missouri Botanical Garden have given valued information on a variety of points on which their expert judgment was consulted. Prof. M. E. Jones, whose extensive collection has been of great aid in determining ranges, etc., particularly in the species of the Great Basin, has also kindly furnished important data regarding the variation, habitats, and climatic preferences of certain species. Miss Mary A. Day, Librarian of the Gray Herbarium, has given much assistance in the bibliography, verification, and proof-reading.

To all these persons who have so readily responded to requests and whose coöperation has added much to the completeness of the present paper the writer expresses his sincere gratitude.

During the preparation of this paper upward of three thousand specimens of *Brickellia* have been examined. Of most of the species the amount of material seen was amply sufficient, not merely to show the diagnostic traits, but to give a fair basis for judgment as to variability, range, seasonal development, etc. In the case of several Mexican and South American species, however, our knowledge still rests

upon a single collection of each. In some of these cases as for instance in *B. pulcherrima*, *B. lancifolia*, and *B. saltillensis*, the material is of excellent quality even if limited in extent, being at all events sufficient to yield pretty definite characters. On the other hand the central Mexican *B. cymulifera*, the Lower Californian *B. Brandegei*, *B. subsessilis*, and *B. macromera*, and the Brazilian *B. coridifolia* still rest upon single collections in less satisfactory condition and their presentation is correspondingly restricted. Thus *B. cymulifera* is known only in bud, and the material of *B. coridifolia* has achenes still so exceedingly immature as to leave doubt regarding the presence or absence of ribs between the five chief angles, a matter of importance in determining the genus to which it should be referred. On the other hand, *B. subsessilis* is known merely from sterile basal shoots and a single wilted inflorescence collected long after anthesis. If better material of any of these species is found in herbaria not examined, information of the fact would be gratefully received.

Citation of Exsiccatae

It has seemed best to cite practically all numbered exsiccatae examined, and also most of the unnumbered specimens. For convenience during the preparation of the paper memoranda were preserved recording the herbaria in which each specimen was found, and as this information seems likely to be at least occasionally helpful to those using the paper it has been included in the publication, the herbaria being in general mentioned in the order in which they were examined.

For the following collections these citations will be found to be practically complete to date: the Gray Herbarium (Gray.), the herbarium of the Missouri Botanical Garden (Mo.), Capt. John Donnell Smith's herbarium (J. D. Sm.), the herbarium of the University of California (Univ. Calif.), the main herbarium of the New York Botanical Garden (N. Y.), the herbarium of the Philadelphia Academy of Natural Sciences (Phil.), the general herbarium and type collection of the United States National Museum (U. S.), the herbarium of the Arnold Arboretum (Arn. Arb.), and the herbarium of Prof. M. E. Jones of Salt Lake City (Jns.). Besides these collections cited in detail, many individual specimens, kindly lent to the writer, have been cited from the Field Museum of Natural History in Chicago (Field Mus.) and from the Rocky Mountain Herbarium of the University of Wyoming (Univ. Wyo.). At two herbaria visited, although all specimens of the genus *Brickellia* were examined, time at the writer's disposal did not permit a full enumeration of the exsiccatae seen. These were the herbarium of Brown University and the herbarium of Columbia University now on permanent deposit at the New York Botanical Garden. How-

ever, it may be said in regard to both these valuable collections that the plants they contain were for the most part collected prior to 1890 and are in nearly all instances duplicated in certain of the larger herbaria (notably N. Y., U. S., and Gray.) which are fully cited. A few plants in foreign herbaria, chiefly types examined by the writer during journeys in Europe in 1900, 1905, and 1910, and a small number of specimens lent from European herbaria for study and identification at the Gray Herbarium, have also been cited, the herbaria being designated by the conventional and self-explanatory abbreviations (Kew., Brit. Mus., Par., DC., Berol., etc.).

SYSTEMATIC TREATMENT OF THE GENUS

BRICKELLIA Ell. Sk. ii. 290 (1822–4, verisimiliter 1822) [1]

Capitula homogama tubiflora 3–∞-flora. Involucri cylindrici vel campanulati squamae numerosae plerumque tenues striatae pluriseriatim imbricatae, intimae saepius lineares, intermediae plerumque anguste oblongae gradatim breviores, extimae saepissime ovatae brevissimae rarius herbaceae et elongatae appressae vel nonnumquam squarrosae. Receptaculum nudum (rarissime marginem versus paullo paleiferum) glabrum vel breviter pubescens saepius planum. Corolla saepius graciliter tubulata sine faucibus distinctis rare in tubum proprium breve et fauces cylindricas paullulo differentiata. Dentes limbi 5 deltoidei vel oblongo-lanceolati aequales quam tubum 5–10-plo breviores. Antherae apice appendiculatae basi rotundatae. Styli basi plus minusve globoso- vel cylindrico-ampliati et saepe pubentis rami clavellati et longe exserti rariter filiformes et vix exserti. Achaenia prismatica vel deorsum paullo decrescentia 10-costata rarissime 5–8- vel ca. 20-costata saepius saltem in costis hispidula rarius sericea vel glandulari-puberula basi callosa. Pappi setae 10–80 capillares plerumque tenues rariter firmiusculae aequales vel conspicuiter inaequales sublaeves vel barbellatae vel rare subplumosae albae vel rarius fulvescentes vel purpureo-tinctae corollam subaequantes.

Nutt. Trans. Am. Phil. Soc. ser. 2, vii. 287–8 (1840); Torr. & Gray, Fl. ii. 79 (1841); Gray, Pl. Wright. i. 83–7 (1852), ii. 71–3 (1853), & Syn. Fl. i. pt. 2, 103–8 (1884); Benth. & Hook. f. Gen. Pl. ii. 247 (1873); Bak. in Mart. Fl. Bras. vi. pt. 2, 372, tt. 101–2 (1876); Hemsl. Biol. Cent.-Am. Bot. ii. 104–7 (1881); O. Hoffm. in Engl. & Prantl, Nat. Pflanzenf. iv. Abt. 5, 142 (1890).

Coleosanthus Cass. Bull. Soc. Philom. 1817, p. 67 (1817), & Dict. x. 36 (1818); Ktze. Rev. Gen. i. 327-8 (1891); Greene, Erythea, i. 53–6 (1893).

Rosalesia La Llav. in La Llav. & Lex. Nov. Veg. 9 (1824).

Clavigera DC. Prod. v. 127 (1836).

Bulbostylis DC. l. c. 138 (1836); Torr. & Gray, Fl. ii. 79 (1841).

Bolbostylis [DC.] Hook. & Arn. Bot. Beech. 297 (1840), non Gardn.

Ismaria Raf. Sylv. Tellur. 117 (1838).

Bulbostyle [DC.] Hook. f. & Jacks. Ind. Kew. i. 338 (1893), in synon.

Herbae rarius annuae saepius perennes vel suffruticosae vel vere fruticosae. Radices fibrosae et tenues vel fusiforme incrassatae. Caules saepius erecti simplices vel ramosi saepius foliosi. Folia opposita vel alterna vel rarissime verticillata

[1] Genus Johanni Brickellio, anglice *John Brickell*, 1749–1809, hibernico Savannae georgensis incolae doctori medico et botanico diligenti Muhlenbengii et Elliottii amico dedicatum. Cf. Robinson, Rhodora, xviii. 225–230 (1916).

sessilia vel petiolata. Inflorescentia saepius paniculata rariter simplice racemosa vel cymosa vel corymbosa. Corollae albae vel roseae vel purpureae vel ochroleucae.

Species 91, mesophyticae vel xerophyticae Americae temp. bor. et trop. incolae.

CLAVIS SECTIONUM.

a. Annuae (vide notam sub *B. filipede*, p. 27). Capitula 7–14-flora diffuse paniculata. Receptaculum calvum glabrum. Corollae dentes deltoidei
Sect. 1. LEPTANTHODIUM (p. 24).

a. Perennes herbaceae vel suffruticosae vel fruticosae *b.*

b. Corollae dentes oblongo-lanceolati vel lineari-oblongi. Capitula parva numerosissima corymbosa vel thyrsoidea. Pappus subplumoso-barbatus purpureus. Herbae mexicanae.....Sect. 2. STEVIASTRUM (p. 27).

b. Corollae dentes ovato-deltoidei *c.*

c. Receptaculum marginem versus paleiferum. Capitula ca. 8-flora. Involucri squamae pro genere paucissimae (ca. 10). Folia linearia integra alterna. Frutex brasilianus..... Sect. 3. PSEUDOCARPHEPHORUS (p. 29).

c. Receptaculum omnino epaleaceum *d.*

d. Capitula 3–5(–7)-flora. Pedicelli non gemmiferi *e.*

e. Involucri squamae multi(9–11)-striatulae ellipticae rubescentes. Folia lineari-acicularia alterna. Frutex brasilianus.....Sect. 4. PITYOPHYLLUM (p. 30).

e. Involucri squamae 3–6-striatae. Frutices xerophytici Americam Borealem occidentalem incolentes.....Sect. 5. XEROBRICKELLIA (p. 31).

d. Capitula 4–20-flora. Pedicelli gemmiferi. Frutices xerophytici mexicani et neo-mexicani et arizonici..... Sect. 6. GEMMIPEDIUM (p. 33).

d. Capitula parva vel mediocra 8–26-flora. Pedicelli nunquam gemmiferi..... Sect. 7. BULBOSTYLIS (p. 36).

d. Capitula 28–∝-flora plerumque pro genere majuscula *f.*

f. Involucri squamae interiores apice non expansae. Capitula 28–62-flora..... Sect. 8. EUBRICKELLIA (p. 97).

f. Squamae interiores in appendicem ovatam vel suborbicularem expansae. Capitula maxima ca. 100-flora terminalia solitaria
Sect. 9. MACROBRICKELLIA (p. 120).

SECT. 1. LEPTANTHODIUM, SECT. NOV.

Capitula parva (7–14-flora). Involucri gracillimi squamae ca. 20 longitudine valde inaequales laxe imbricatae tenuissimae post achaeniorum delapsum persistentes et reflexae. Receptaculum calvum glabrum. Corolla tubiformis dentibus limbi brevissimis deltoideis. — Herbae annuae erectae foliis ovatis tenuibus petiolatis oppositis vel saltem superioribus saepe alternis, inflorescentia paniculata perlaxa.

Species 2, quarum una late per Americam calidiorem distributa altera ad rei publicae mexicanae partem austro-occidentalem restricta est.

CLAVIS SPECIERUM.

Involucri squamae interiores ad apicem acutatae dorso 1–3-striatae. Styli rami filiformes.....1. *B. diffusa.*

Involucri squamae interiores apice rotundatae dorso 4–5-striatae. Styli rami clavellati.....2. *B. filipes.*

1. B. DIFFUSA (Vahl) Gray, Pl. Wright. i. 86 (1852)

Annua sparse puberula vel glabriuscula .08–2 m. alta; caule solitario tereti basi simplici supra diffuse paniculatimque ramoso; ramis ramulisque tenuibus patentibus; foliis caulinis suborbiculari- vel deltoideo-ovatis 4–6 cm. longis 2.5–4 cm. latis tenuibus utrinque viridibus cum glandulis minutis lucidis punctatis acuminatis serratis vel crenato-dentatis petiolatis, superioribus lanceolatis; bracteis lanceolati-linearibus sessilibus; pedicellis filiformibus patentibus 8–18 mm. longis; involucri squamis extimis minimis subulatis inter se plus minusve distantibus et in pedicellum paullulo errantibus, squamis intermediis et interioribus anguste lanceolati-linearibus 2–3-nerviis tenuibus subscariosis pallide viridibus; capitulis gracilibus ca. 8-floris ca. 8 mm. longis; corollis viridi-albis 4–4.3 mm. longis; styli ramis filiformibus flavescentibus flexuosis; pappi setis delicatule capillaribus ca. 24 albis; achaeniis 1.7–2 mm. longis fusco-griseis sursum villosis. — Nunc in silvis humidis et locis umbrosis nunc in terris apertis frequens et per Americam calidiorem late distributa. (FIG. 1.)

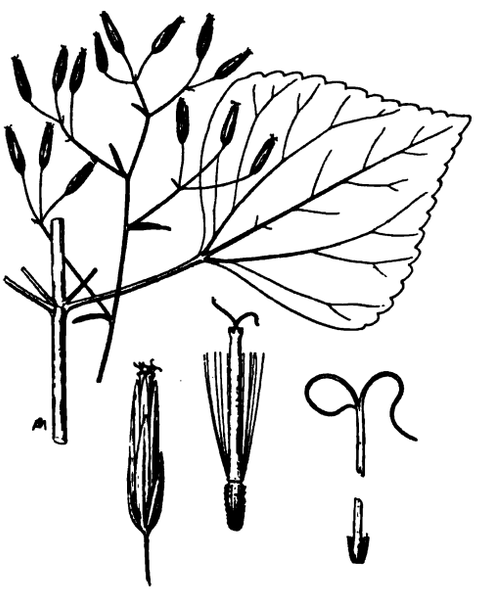

FIG. 1. B. diffusa.

Griseb. Fl. Brit. W. Ind. 356 (1861); Bak. in Mart. Fl. Bras. vi. pt. 2, 373, t. 102 (1876); Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881); Robinson, Proc. Am. Acad. xlvii. 200 (1911).
Eupatorium diffusum Vahl, Symb. iii. 94 (1794).
E. capillare Desv. in Hamilton, Prod. Pl. Ind. Occ. 51 (1825) fide DC. Prod. v. 174 (1836).
E. flaccidum Spreng. ex DC. Prod. v. 174 (1836).
Bulbostylis diffusa (Vahl) DC. Prod. vii. 268 (1838).
Eupatorium leptopodum Gardn. in Hook. Lond. Jour. Bot. v. 478 (1846).
E. trichosanthum A. Rich, Fl. Cub. Fanerog. ii. 41 (1853).
Coleosanthus diffusus (Vahl) Ktze, Rev. Gen. i. 328 (1891).

MEXICO: CHIHUAHUA: in parte aust.-occ., *Palmer* (anno 1885), n. 166 (hbb. Gray., U. S.). SINALOA: ad Culiacan, *Schaffner* (hb. Gray.), *Brandegee* (hbb. Gray., Univ. Calif., U. S.); ad fontes fluminis Mazatlan, *W. G. Wright*, n. 1290 (hbb. Gray., Mo., Univ. Calif., U. S.). TEPIC: prope Acaponetam, *Rose, Standley & Russell*, n. 14,202 (hb. U. S.). JALISCO: collibus silvestribus prope Guadalajaram, *Pringle*, n. 2174 (hb. Gray.); sub rupibus siccis in vallicula praerupta Tequila, *Pringle*, n. 5369 (hb. U. S.). COLIMA: *Palmer* (anno 1891), n. 1188 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., U. S.). SAN LUIS POTOSI et TAMAULIPAS: inter urbes San Luis Potosi et Tampico, *Palmer* (1878–9), n. 1086 (hbb. Gray., U. S.); prope Victoriam, alt. 320 m., *Palmer* (anno 1907),

n. 162 (hbb. Gray., Mo., N. Y., U. S.); inter Tulam et Tampico, *Berlandier*, nn. 727 (hbb. Gray., U. S.), 3163 (hbb. Gray., N. Y., U. S.); ad Santa Rafaela, *Berlandier*, n. 2144 (hbb. Gray., Phil., U. S.). HIDALGO: ad Huejutlam, *C. & E. Seler*, n. 618 (hb. J. D. Sm.). VERA CRUZ: ad Cordovam, *Bourgeau*, n. 2033 (hb. Gray.); ad Mirador. *Sartorius* (hb. Gray.); ad Zacuapan, *Purpus*, n. 2191 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); ad Santa Lucretia, *C. L. Smith*, n. 581 (hbb. Gray., Mo., N. Y., U. S.); ad Tuxtlam, *C. & E. Seler*, n. 1925 (hbb. Gray., N. Y.); ad Sanborn, *Orcutt*, n. 3066 (hb. Mo.). OAXACA: in vallicula praerupta Cuicatlan, alt. 610 m., *Pringle*, n. 6032 (hbb. Mo., J. D. Sm., Univ. Calif., Phil.), *E. W. Nelson*, n. 1871 (hb. U. S.). YUCATAN: ad Izamal, *Gaumer* n. 1080 (hb. N. Y.).

GUATEMALA: ad Esquintlam, alt. 335 m., *J. D. Smith*, n. 2386 (hb. J. D. Sm.); Dept. Santa Rosa, ad Teocinte, alt. 762 m., *Heyde & Lux* (distrib. J. D. Sm.), n. 4198 (hbb. Gray., J. D. Sm., U. S.); Dept. Alta Verapaz, ad Pansajché, alt. 150 m., *v. Tuerckheim*, n. II. 2265 (hb. J. D. Sm.).

HONDURAS: Dept. Santa Barbara, ad San Pedro Sula, alt. 244 m., *Thieme* (distrib. J. D. Sm.), n. 5317 (hbb. Gray., Mo., J. D. Sm., U. S.).

SAN SALVADOR: *Velasco* (distrib. J. D. Sm), n. 8983 (hb. J. D. Sm.).

COSTA RICA: in locis apertis, Rodeo de Pacaca, *Pittier*, n. 3277 (hb. Gray.); in glareis fluminis Ceibo, *Pittier*, n. 4928 (hb. Gray.), *Tonduz*, n. 4928 (hbb. J. D. Sm., U. S.); ad Ujarras de Buenos-Aires, *Pittier*, n. 10,624 (hbb. J. D. Sm., U. S.); in arbustis ad Nicoyam, *Tonduz*, n. 13,604 (hb. Gray.).

NICARAGUA: *Wright* (hbb. Gray., U. S.); in monte El Viejo, *Baker*, n. 2167 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); prope Granadam, *Lévy*, n. 438 (hb. Hafn.).

PANAMA: ad Veraguas, *Seemann*, n. 1584 (hb. Gray.).

CUBA: in parte orientali, *Wright*, n. 293 (hbb. Gray., Mo.).

JAMAICA: ad St. Thomas in Vale, *Alexander* (hbb. Gray., N. Y.); secundum flumen Banana nominatum, *Eggers*, n. 3436 (hb. J. D. Sm.).

SANTO DOMINGO: ad San Pedro de Mecoris, *Rose, Fitch & Russell*, n. 4202 (hbb. N. Y., U. S.); prope Barahonam, *Fuertes*, n. 325 (hbb. Gray., Mo., N. Y.).

TRINIDAD: *Lockhart* fide Griseb.; *Kuntze*, n. 692 (hb. N. Y.).

COLUMBIA: *Triana*, n. 1176 (hb. J. D. Sm.); ad Santa Marta, *H. H. Smith*, n. 622 (hbb. Gray., Mo., Phil., U. S.).

VENEZUELA: prope Tovar, alt. 610 m., *Fendler*, n. 1942 (hb. Gray.); inter La Guayra et Caracas, *Kuntze*, n. 1206 (hb. N. Y.); prope Caracas, alt. 1067 m., *Fendler*, n. 633 (hb. Gray.).

BRASILIA: in umbrosis fluminis Parana, *Riedel*, n. 1527 = 2406 (hb. Gray.); sine loco exactiore, *Riedel*, n. 1001 (hb. Gray.), *Burchell*, n. 7424 (hb. Gray.).

BOLIVIA: ad Santa Cruz, *Kuntze* (hbb. N. Y., U. S.); ad Velasco occ., *Kuntze* (hb. N. Y.).

ECUADOR: *Lehmann*, n. B. T. 1116 (hb. N. Y.).

INS. GALAPAGOS: Albemarle Insula (ubi verisimiliter nuper introducta), *Snodgrass & Heller*, nn. 51, 72, 93, 214 (omnes in hb. Gray.); *Stewart*, nn. 756, 757, 758.

2. **B. filipes**, SPEC. NOV.

Erecta glabriuscula verisimiliter 1 m. vel ultra alta (basi ignota); caule brunneo ramoso teretiusculo; foliis superioribus plerisque alternis late ovatis obtuse acuminatis paullo crenato-serratis ad 4 cm. longis 3 cm. latis utrinque viridibus supra glabris subtus cum glandulis parvis globularibus sessilibus lucentibus dense ornatis; petiolo gracili 1–2.3 cm. longo; panicula laxa multicapitulata 5–6 dm. alta 2.5 dm.

diametro; bracteis lanceolato-oblongis vel -linearibus sessilibus; pedicellis filiformibus ad 1.7 cm. longis; capitulis graciliter cylindratis saepe nutantibus 1 cm. altis ca. 14-floris; involucri squamis purpurascentibus, extimis minimis sed vix in pedicellum errantibus, intermediis anguste oblongis 4–5-costatis, intimis lineari-oblongis apice rotundatis; corollis exacte tubulatis 5.6 mm. longis, dentibus limbi brevissimis; styli ramis exsertis distincte clavellatis post exsiccationem atrobrunneis; achaeniis 22. mm. longis griseis sursum minute hirtellis; pappi setis ca. 32 albis sublaevibus. — Mexico. (FIG. 2.)

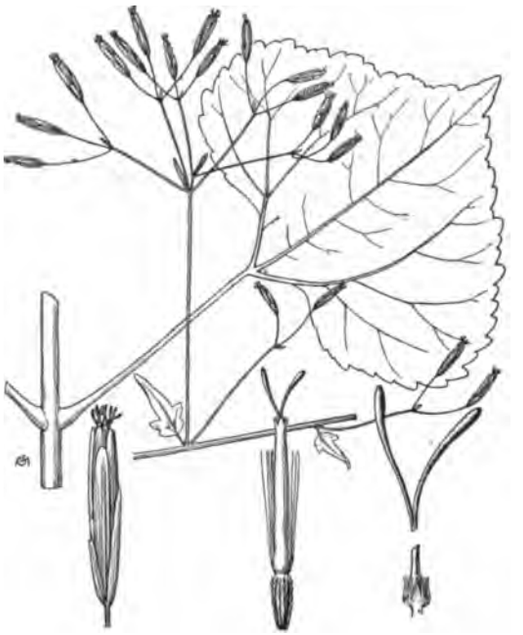

FIG. 2. B. filipes.

MEXICO: GUERRERO: ad Sihuatanejo, 9 Apr. 1903, *E. W. Nelson*, n. 7009 (specimen typicum in hbb. Gray., U. S.); etiam ad Jimalcotam, alt. 150 m., *Langlassé*, n. 682 (hbb. Gray., U. S.), foliis inferioribus latissimis, usque ad 10.5 cm. latitudine, latioribus quam longis.

NOTA. — Duratio vitae apud hanc speciem quamquam verisimiliter annua tamen hucusque (basi deficiente) non certe cognita. Species nihilo minus ob habitum et inflorescentiam laxissimam et capitula gracillima ad *B. diffusam* quam proxima ut videtur apponenda.

Sect. 2. **STEVIASTRUM**, SECT. Nov.

Capitula parva 8–11-flora dense aggregata corymbosa vel thyrsoidea. Receptaculum calvum glabrum. Corollae dentes oblongi vel sublineares pro genere longiusculi. Pappi setae purpurascentes breviter sed distincte plumosae. — Herbae perennes foliis lanceolatis integris plerisque alternis. Species 3, mexicanae.

CLAVIS SPECIERUM

Inflorescentia dense corymbosa planiuscula vel leviter convexa. Achaenia 5 mm. longa ..... 3. *B. pulcherrima.*

Inflorescentia laxe thyrsoidea vel pyramidaliter paniculata. Achaenia vix 3 mm. longa.

Involucri squamae lanceolatae, interiores glabriusculae longitudine flosculis dimidio minores ..... 4. *B. solidaginifolia.*

Involucri squamae ovato-oblongae vel -ellipticae, interiores glanduloso-puberulae vel -pulverulae saltem tres quartas vel quattuor quintas longitudinis flosculorum aequantes ..... 5. *B. thyrsiflora.*

3. B. PULCHERRIMA Robinson, Proc. Bost. Soc. Nat. Hist. xxxi. 268 (1904)

Erecta obscure crispeque puberula; caule tereti folioso; foliis anguste lanceolatis integris attenuatis saepius conduplicatis patentibus vel reflexis 5–10 cm. longis usque ad 18 mm. latis, petiolo 1–3 mm. longo; capitulis 8–9-floris 14–15 mm. altis ca. 4.5 mm. diametro in corymbos 5–12 cm. diametro densos congestis; involucri squamis ca. 7 lineari-oblongis acutis viridibus obscure 3-nerviis laxe imbricatis; corollae laete roseae tubo 6.5 mm. longo sine faucibus ullis distinctis, dentibus

FIG. 3. B. pulcherrima.

FIG. 4. B. solidaginifolia.

limbi anguste oblongis acutiusculis patentibus 1.1 mm. longis; achaeniis 5 mm. longis saepe 9-costatis in costis sursum puberulis in intervallis glandulari-atomiferis. (FIG. 3.)

MEXICO: MORELOS: collibus calcareis ad Yautepec prope Cuernavacam, alt. 1225 m., *Pringle*, nn. 8753 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.), 11,336 (hb. Gray.). Species speciosissima loco in hortis conservatoriisque certe digna.

4. B. SOLIDAGINIFOLIA Gray, Proc. Am. Acad. xxii. 306 (1887)

Erecta e rhizomate crassiusculo horizontali 6–9 dm. alta crispe puberula; caule infra simplici supra mediam partem ramosissimo; ramis adscendentibus foliosis simplicibus in corymbos particulares 1.5–3 cm. diametro terminantibus; foliis plerisque alternis anguste lanceolatis attenuatis integris sessilibus ad 6 cm.

longis et 9 mm. latis fere a basi 3-nerviis leviter reticulatis utrinque puberulis et glandulari-atomiferis; capitulis subcylindratis 11 mm. altis 4.5 mm. diametro; involucri ca. 6 mm. alti squamis (15–17) anguste oblongis vel oblongo-lanceolatis; corollae tubo 6 mm. longo, dentibus limbi oblongo-lanceolatis 0.6 mm. longis; achaeniis 3–3.8 mm. longis in costis sursum hispidulis in intervallis saepius glaberrimis. (FIG. 4.)

MEXICO: CHIHUAHUA: in declivitatibus siccis frigidulis montium Mapula, *Pringle*, n. 744 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.); inter Parral et Batopsin, *Goldman*, n. 155 (hbb. Gray., N. Y., U. S.). COAHUILA: in collibus prope locum General Capeda nominatum, *Pringle*, n. 13,666 (hbb. Gray., U. S.). DURANGO: ad Sandiam, alt. 2200 m., *Pringle*, n. 13,537 (hbb. Gray., U. S.); prope urbem Durango, *Palmer* (anno 1896), n. 840 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.)

5. B. THRYSIFLORA Gray, Proc. Am. Acad. xv. 30 (1879)

Praecedenti habitu foliis pubescentia etc. simillima; capitulis ad apices ramorum dense subracemoso-corymbosis, corymbis particularibus thyrsum magnum 3–4 dm. altum 11–18 cm. diametro conjunctim formantibus; involucri subcylindrici 10.5 mm. alti 4.4 mm. diametro squamis ca. 20 ovatis vel ovato-oblongis omnibus puberulis; corollis et achaeniis ut apud praecedentem. (FIG. 5.)

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881).
Coleosanthus thyrsiflorus (Gray) Ktze. Rev. Gen. i. 328 (1891).

FIG. 5. B. thyrsiflora.

MEXICO CENT.: SAN LUIS POTOSI: in umbrosis montium, *Parry & Palmer*, nn. 362 (hbb. Gray., Mo., Phil., U. S.), 375 (hb. Mo.), *Schaffner*, nn. 290 (hbb. Gray., N. Y., Hafn.), 721 (hbb. N. Y., U. S., Hafn.).

SECT. 3. **PSEUDOCARPHEPHORUS,** SECT. NOV.

Capitula magnitudine mediocra sed pauci(ca. 8)-flora. Involucri squamae (ca. 10) laxe imbricatae. Receptaculum marginem versus paullo paleiferum. Corollae dentes ovato-oblongi. Pappi setae sursum breviter plumosae. — Frutex erectus brasilianus foliis angustissimis alternis.

6. B. (?) CORIDIFOLIA (DC.) Robinson, Proc. Am. Acad. xlvii. 200 (1911)

Crispe puberula et plus minusve glandulosa; caule ramisque erectis dense foliosis post delapsum foliorum per cicatrices prominulentes asperatis; foliis anguste linearibus subadpresse adscendentibus integerrimis 11–14 mm. longis 0.6–0.7 mm. latis sessilibus acutis glabris margine revolutis; capitulis ad apices ramorum in corymbos parvos dispositis; involucri squamis valde inaequalibus lanceolatis vel anguste oblongis acutis dorso glandulosotomentellis; corollis 7–8 mm. longis, dentibus limbi 0.5 mm. longis; achaeniis immaturis papillosis deorsum paullo decrescentibus 5-costatis ut videtur cum costulis intermediis obscuris. (FIG. 6.)

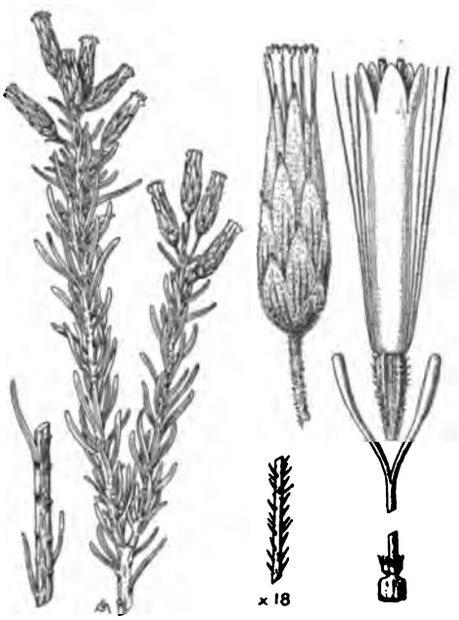

FIG. 6. B. coridifolia.

Carphephorus coridifolius DC. Prod. vii. 267 (1838).

BRASILIA: MINAS GERAËS: in Serro do Frio, *Vauthier*, n. 314 (hbb. DC., Gray.).

NOTA. — Planta ut videtur in herbariis rarissima et minime cognita. Quod ad affinitatem generalem attinet haec species solis e speciminibus immaturis cognita est adhuc dubitativa. Sine achaeniis melius evolutis comperire non possum seu ea vero (8–)10-costata seu simplice 5-angulata absque costis intermediis sint, igitur seu species vera generis *Brickelliae* seu potius ad *Eupatorium* referenda.

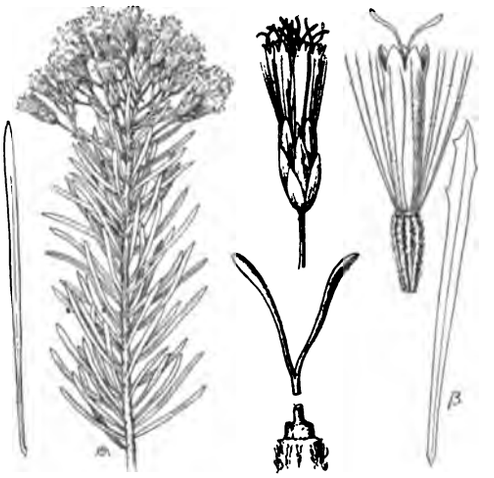

FIG. 7. B. brasiliensis.

SECT. 4. **PITYOPHYLLUM,** SECT. NOV.

Capitula minima (3–4-flora) corymbosa. Involucri squamae (ca. 10) valde inaequales ellipticae obtusiusculae multistriatulae firmiusculae brunnescentes. Receptaculum calvum glabrum. Corollae dentes ovato-deltoidei. Pappi setae valde inaequales stramineo-fulvescentes sursum barbellato-plumosae. — Frutices brasiliani foliis aciculari-linearibus numerosissimis alternis.

7. B. BRASILIENSIS (Spreng.) Robinson, Proc. Am. Acad. xlvii. 199 (1911).

Fruticosa ramosa 1–2 m. alta glaberrima; caule ramisque erectis dense foliosis post delapsum foliorum per cicatrices prominulentes asperatis; foliis adscendentibus angustissimis 1.2–3 cm. longis crassiusculis 1-nerviis sessilibus acutis; corollis ca. 5 mm. longis; achaeniis hirsutis 4 mm. longis. (FIG. 7.)

Eupatorium brasiliense Spreng. Syst. iii. 417 (1826); DC. Prod. v. 182 (1836).
Clavigera pinifolia Gardn. in Hook. Lond. Jour. Bot. v. 461 (1846) maxima ex parte, ergo
Brickellia pinifolia (Gardn.) Gray, Pl. Wright. i. 84 (1852); Bak. in Mart. Fl. Bras. vi. pt. 2, 372 (1876) excl. syn. *Carphephorus coridifolius* DC.
Mikania ericoides Mart. ex Bak. l. c. (1876).
Coleosanthus pinifolius (Gardn.) Ktze. Rev. Gen. i. 328 (1891) ubi in loco auctoris parenthetici " Spreng." per errorem citatus est.

BRASILIA: MINAS GERAËS: *Claussen* (hb. Gray.); *Gardner*, n. 4847 (hb. Gray.); *Glaziou*, n. 14,027 (hb. Univ. Calif.). GOYAZ: *Glaziou*, n. 21,616 (hbb. Gray., N. Y., U. S.). In campis editis inter Francam et flumen Parana, *Riedel*, n. 1511 = 1945 (hb. Gray.). Sine loco exactiore: *Martius*, n. 783 (hb. Gray.); *Riedel*, n. 834 (hb. Gray.); *Burchell*, n. 5778 (hb. Gray.). Varietates duae ut videtur distinguendae.

Var. α. **typica**, foliis fere acicularibus 0.6–0.8 mm. latis integerrimis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **pernambucensis**, var. nov., foliis latioribus 1.8 mm. latis apicem versus saepius 1-dentatis; aliter var. *typicae* simillima. (FIG. 7 β.)

Clavigera pinifolia Gardn. in Hook. Lond. Jour. Bot. v. 461 (1846) solum quoad n. 2898 neque quoad nn. 4846, 4847 nec quoad descriptionem (fol. integerrimis dimidium lin. latis).

BRASILIA: PERNAMBUCO: in collibus frutectosis prope Rio Petro, *Gardner*, n. 2898 (hb. Gray.), sub nomine *Diplostephium* distributa.

NOTA. — Phyllotaxis apud utramque varietatem hujus speciei primo aspectu obscura sit tamen simpliciter explicanda est. Folia axis primordii normale spiraliter disposita sunt, sed in axillis eorum axes secundarii brevissimi saepius 2–3-foliati orientur et iidem cum foliis axis primordii quasi folia profunde 3–5-divisa videntur. Ita dicit Spreng. ll. cc. " foliis * * * 5–3-partitis." Cf. etiam Gardner, l. c.

SECT. 5. XEROBRICKELLIA, SECT. NOV.

Capitula pro genere minima 3–5(–7)-flora in paniculas amplas plus minusve thyrsoideas folioso-bracteatas disposita. Receptaculum calvum glabrum. Dentes corollae breves ovato-deltoidei. — Frutices ramosi xerophytici. Species 3, Am. Bor. occ. incolae.

CLAVIS SPECIERUM

Involucri squamae 10–12. Folia linearia ..... 8. *B. longifolia.*
Involucri squamae ca. 20. Folia lanceolata vel ovata.
Folia integra. Involucri squamae subglabrae ..... 9. *B. multiflora.*
Folia dentato-serrata. Involucri squamae pleraeque puberulo-tomentellae . 10. *B. Knappiana.*

8. B. LONGIFOLIA Wats. Am. Nat. vii. 301 (1873)

Fruticosa ramosissima glabra; caule ramisque gracilibus a cortice albido paullulo scabrido tectis; foliis alternis linearibus attenuatis integris vel obscure obsoleteque denticulatis 3–13 cm. longis 2–10 mm. latis 3-nerviis utrinque puncticulatis breviter petiolatis; capitulis minimis 3–5-floris ad apices ramulorum etiam rarius in axillas subcymuloso-aggregatis; cymulis 3–9-capitulatis laxiusculis; involucri squamis valde inaequalibus, exterioribus ovatis brevissimis, interioribus linearibus 3-nerviis persistentibus; receptaculo glabro; achaeniis griseis 1.8 mm. longis sursum in costis hirtellis. — Am. Bor. occ. (FIG. 8.)

FIG. 8. B. longifolia.

Rothr. in Wheeler, Rep. vi. 139, t. 5 (1878); Gray, Syn. Fl. i. pt. 2, 108 (1884).

Coleosanthus longifolius (Wats.) Ktze. Rev. Gen. i. 328 (1891); Coville, Contrib. U. S. Nat. Herb. iv. 120 (1893).

NEVADA: in parte australi, *Wheeler* (hb. Gray.); ad Panacam, *Jones* (hbb. Gray., Univ. Calif.).

UTAH: in parte australi ad Kanab, *Thompson* (hb. Gray.); ad St. George, *Palmer*, anno 1875 (hbb. Gray., Mo., Phil.); ad Rockville, alt. 1220 m., *Jones*, n. 6081 (hbb. Mo., Univ. Wyo., Univ. Calif., N. Y., U. S., Jns.); ad basin montis Ellen in montibus Henry dictis, *Osgood* (hb. U. S.).

ARIZONA: in Grand Cañon, *Bishop* (hb. Jns.); secundum rivulum Shinamo prope Grand Cañon, *Pilsbry* (hb. Phil.).

CALIFORNIA OR.: fide Covillei, l. c., in locis sequentibus: valliculis praeruptis Surprise et Willow Creek dictis in montibus Panamint, declivitate occidentali montium Inyo, prope Swanseam, prope ostium rivuli Cottonwood nominati, in litore occidentali lacus Owens. Specimina californica a me non visa.

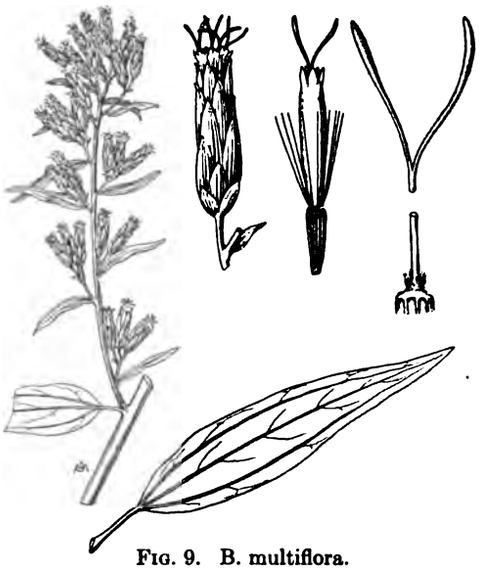

FIG. 9. B. multiflora.

9. B. MULTIFLORA Kellogg, Proc. Calif. Acad. vii. 49 (1877)

Fruticosa erecta ramosa 5–9 dm. alta; caule ramisque albidis striatis glabris vel paullo scabridis; foliis alternis ovato-lanceolatis acutis integerrimis vel obsolete denticulatis sparse hispidulis glanduloso-punctatis

plus minusve vernicoso-viscidis breviter petiolatis fere a basi 3-nerviis 3.5–8.7 cm. longis 1.2–2.8 cm. latis concoloribus; capitulis breviter pedicellatis 3–5-floris ca. 7 mm. altis numerosissimis in paniculam pyramidalem folioso-bracteatam subdense dispositis; involucri squamis ca. 22 valde inaequalibus 3-nerviis; receptaculo glabro; achaeniis 1.7 mm. longis. — Am. Bor. occ. (Fig. 9.)

Greene, Bull. Calif. Acad. i. 8 (1884); Gray, Syn. Fl. i. pt. 2, 108 (1884).
Coleosanthus multiflorus (Kellogg) Ktze. Rev. Gen. i. 328 (1891).

CALIFORNIA: rupibus montium Sierra Nevada ad King's Cañon, *Kellogg* (hb. Gray.); arenosis, Inyo com., *Purpus*, n. 3050 (hb. Univ. Calif.).

NEVADA: ad Soda Springs Cañon, Esmeralda com., alt. 1830 m., *Shockley*, n. 551 (hbb. Gray., Univ. Calif.).

10. B. Knappiana Drew, Pittonia, i. 260 (1888)

Fruticosa ramosa 0.4–2.4 m. alta plus minusve hispidula et viscida; caule ramisque flexuosis argenteis; foliis alternis lanceolatis vel ovato-lanceolatis glandulari-punctatis 2.5–3.6 cm. longis 1–1.6 cm. latis rarius subintegris saepius utroque cum dentibus 1–4 prorsus vergentibus munitis basi cuneatis; petiolo gracili 4–5 mm. longo; capitulis minimis 7 mm. altis 5–7-floris gracilibus quam eis praecedentis paucioribus in paniculam foliosissimam dispositis; involucri squamis dorsaliter plus minusve praecipue apicem versus puberulis; achaeniis 2.6 mm. longis pallide stramineis sursum hispidulis; pappi setis tenuissimis ca. 30. — Am. Bor. occ. rara geographice restricta minus cognita. (Fig. 10.)

Fig. 10. B. Knappiana.

Hall, Univ. Calif. Pub. Bot. iii. 33 (1907).
Coleosanthus Knappianus (Drew) Greene, Erythea, i. 54 (1893).

CALIFORNIA OR.-AUST.: Inyo com.: prope flumen Mohave, *Knapp* (hb. Univ. Calif., phot. in hb. Gray.); secundum rivulum ad Pleasant Cañon in montibus Panamint, alt. 915 m., *Hall & Chandler*, n. 6919 (hb. Univ. Calif., phot. in hb. Gray.).

Sect. 6. **GEMMIPEDIUM**, Sect. Nov.

Capitula parva vel mediocra 4–20-flora. Pedicelli et ramuli inflorescentiae cum gemmis parvis plerisque oppositis 1–pluri-jugis instructi. — Frutices saepius pube-

ruli foliis lineàribus vel parvis et ovatis. Species 3, boreali-mexicanae et neo-mexicanae et arizonicae.

CLAVIS SPECIERUM

a. Folia linearia vel anguste lanceolata. Capitula 4–12-flora. Corollae albae vel roseo-tinctae *b.*
  b. Folia integerrima. Capitula (6–)8–12-flora ..... 11. *B. squamulosa.*
  b. Folia spinuloso-serrata. Capitula 4–5-flora ..... 12. *B. spinulosa.*
a. Folia ovata serrata. Capitula ca. 20-flora. Corollae atropurpureae ..... 13. *B. vernicosa.*

11. B. SQUAMULOSA Gray, Proc. Am. Acad. xv. 30 (1879)

Fruticosa brevissime griseo-tomentella 4–6 dm. alta; caulibus erectis basi simplicibus superne fastigiatim ramosis; foliis caulinis (saepius ante anthesin delapsis) linearibus 3–7 cm. longis 3(–5)-nerviis suboppositis; foliis ramealibus brevissimis squamiformibus oblongis obtusis crassiusculis saepissime tetrastichis congestis; capitulis 11–12 mm. altis rarius 6– saepissime 8–12-floris numerosissimis in paniculam pyramidaliter thyrsiformem dispositis; involucri squamis pluriseriatim imbricatis pallide viridibus obscure 3-nerviis; achaeniis 3 mm. longis apicem versus paullo in costis hispidulis aliter glabris; pappi setis delicatule capillaribus fere simplicibus numerosissimis (plus quam 80) valde inaequalibus. — Am. Bor. aust.-occ. et Mex. bor. et cent. (FIG. 11.)

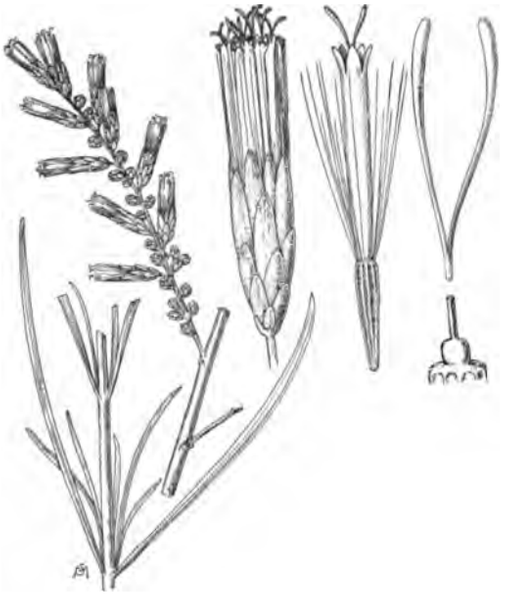

FIG. 11. B. squamulosa.

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881); Gray, Syn. Fl. i. pt. 2, 108 (1884).
Coleosanthus squamulosus (Gray) Ktze. Rev. Gen. i. 328 (1891).

NEO-MEXICO: Prope Santa Rita del Cobre, *Greene*, n. 25 (hb. Gray.); secundum partem superiorem fluminis Gila, *Greene* (hbb. Gray., Phil.).

ARIZONA: prope castellum Huachuca, *Lemmon*, n. 2740 (hbb. Gray., U. S.), *Patzky* (hb. U. S.), *Wilcox*, nn. 253 (hb. U. S.), 410 (hb. U. S.); in montibus Chiricahua, *Toumey*, n. 23 (hb. Univ. Calif.).

MEXICO: CHIHUAHUA: prope urbem ita nominatam, alt. ca. 1300 m., *Palmer* (anno 1908), n. 60 (hbb. Gray., Mo., U. S.), *Pringle*, n. 705 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.). DURANGO: arenosis fluminis, alt. 1891 m., *Palmer* (anno 1896), nn. 1 (hbb. Gray., Mo., Univ. Calif., U. S.), 818 (hbb. Gray., Mo.). SAN LUIS POTOSI: alt. 1800–2450 m., *Parry & Palmer*, n. 356 (hbb. Gray., Mo., Phil., U. S.); in umbrosis prope San Miguelito, *Schaffner*, nn. 364 (hbb. Gray., U. S.), 788 (hbb. N. Y., U. S.), 789 (hb. N. Y.), 798 (hb. U. S.). GUANAJUATO: in arenosis, *W. Schumann*, ad Jaral, n. 145 (hb. Gray.).

12. B. SPINULOSA Gray, Pl. Wright. i. 84 (1852)

Fruticosa 3–4.5 dm. alta ramosissima sordide puberula vel rarius glabriuscula; caulibus ramisque flexuosis adscendentibus; ramis primo anno foliosissimis anno secundo racemoso-capituliferis; foliis anguste lanceolati-linearibus alternis pungentibus 1–1.6 cm. longis spinuloso-serratis saepius proliferis; capitulis ramulos gemmiferos terminantibus 4–5-floris; involucri squamis pluriseriatim imbricatis, intimis glabriusculis 3–5-striatis mucronulatis; corollis albidis; achaeniis superne tomentellis; pappi setis ca. 44 barbellato-subplumosis. (FIG. 12.)

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881).
Clavigera spinulosa Gray, Pl. Fendl. 63 (1849).
Coleosanthus spinulosus (Gray) Ktze. Rev. Gen. i. 328 (1891) ubi in loco auctoris parenthetici DC. per errorem citatus est.

MEXICO BOR. ET CENT.: CHIHUAHUA: prope urbem ita nominatam, a pecore depasta, *Gregg*, nn. 3 (hb. Gray.), 531 (hb. Mo.); alt. 1300 m., *Palmer* (anno 1908), n. 13 (hbb. Gray., Mo., U. S.); planitiebus editis, *Pringle*, n. 1593 (hbb. Mo., Univ. Calif.). DURANGO: prope urbem ita nominatam, *Palmer* (anno 1896), n. 148 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). ZACATECAS: ad urbem ita nominatam, *Jones*, n. 290 (12,043 hb. Jns.). SAN LUIS POTOSI: alt. 1800–2450 m., *Parry & Palmer*, n. 357 (hbb. Gray., Mo., Phil., U. S.); in umbrosis prope Los Ranchos, *Schaffner*, nn. 363 (hbb. Gray., N. Y., U. S.), 787 (hbb. N. Y., U. S.), 790 (hb. N. Y.).

FIG. 12. B. spinulosa.

Var. α. **typica,** foliis utrinque laete viridibus glabris lucidis 1-nerviis cum venis lateralibus obscuris plus minusve reticulatis margine argute serratis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **asperata,** var. nov., foliis utrinque papilloso-asperatis griseis obscuris distinctius 3-nerviis minus argute serratis. (FIG. 12 β.)

MEXICO: CHIHUAHUA: collibus planitiebusque prope urbem Chihuahuam, *Pringle*, n. 210 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.).

13. B. VERNICOSA Robinson, Proc. Am. Acad. xxxvi. 487 (1901)

Frutescens vel fruticosa 3–5 dm. vel ultra altitudine puberula et vernicoso-viscida; foliis caulinis alternis ovatis serratis subacutis coriaceis utrinque laete viridibus 1–1.7 cm. longis 9–12 mm. latis subsessilibus ramealibus anguste lanceo-

lato-oblongis multo minoribus; inflorescentia saepius thyrsiformi; capitulis ramulos breves terminantibus erectis 16 mm. altis 5 mm. diametro ca. 20-floris; involucri squamis ca. 28 valde imbricatis ellipticis vel linearibus distincte ca. 4-striatis saepe purpureo-tinctis viscidule puberulis apice rotundatis, exterioribus gradatim brevioribus; corollis 7 mm. longis atropurpureis; achaeniis sursum hispidulis 4.5 mm. longis; pappi setis ca. 25 laete albis vel purpureo-tinctis minute barbellatis. (Fig. 13.)

Fig. 13. B. vernicosa.

MEXICO: Durango: ad Santiago Papasquiaro, *Palmer* (anno 1896), n. 57 (hbb. Gray., Univ. Calif., N. Y.); ad Tepehuanes, *Palmer* (anno 1906), n. 11 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

Sect. 7. BULBOSTYLIS (DC.) Gray (sensu restricto)

Capitula 8–26-flora. Receptaculum calvum saepius glabrum rarius hirtellum. Pedicelli nunquam gemmiferi. Corollae dentes ovato-deltoidei brevissimi (parte decima tubi breviores). — Herbae perennes vel suffruticosae vel fruticosae mesophyticae vel xerophyticae.

Gray, Pl. Wright. i. 84 (1852), pro parte.
Bulbostylis DC. Prod. v. 138 (1836).

Species 59, Am. Bor. occ. et Mex. et Am. Cent. incolae. Sectio ut videtur solum in subsectiones nonnullas characteribus trivialibus foliorum et dimensionum etc. difficile et minus satis faciente dividenda.

Clavis subsectionum (caute usurpanda)

a. Folia linearia alterna integerrima sessilia. Capitula 10–20-flora corymbosa vel in paniculam elongatam spiciformem vel thyrsiformem disposita Subsect. 1. Clavigera (p. 37).
a. Folia proportione latiora saepius serrata vel dentata vel crenata rare integra *b*.
b. Folia sessilia vel brevissime petiolata (petiolo decimam partem limbi rare superante) *c*.
c. Folia spatulata minima. Frutex intricate ramosus . . . . Subsect. 2. Frutescentes (p 39).
c. Folia ovata vel suborbicularia parva vel minima 6–12(–18) mm. longa. Involucri squamae exteriores plus minusve squarrosae. Frutices xerophytici . . . . . Subsect. 3. Microphyllae (p. 40).
c. Folia lanceolata vel ovato-lanceolata tenuia 1–3(–6) cm. longa basi plus minusve angustata vel rotundata vel subtruncata nec cordata. Suffrutescentes regionis texano-neo-mexicanae . . . . . Subsect. 4. Parvulae (p. 44).
c. Folia oblonga vel elliptica basi angustata, caulina 3 cm. vel ultra longa, saepissime coriacea vel firmiuscula reticulataque . . . . . Subsect. 5. Reticulatae (p. 48).
c. Folia oblonga vel elliptica (rarius oblongo-lanceolata) basi truncata vel cordata . . . . . Subsect. 6. Amplexicaules (p. 54).

b. Folia (saltem caulina) petiolata (petiolo saltem quintam partem limbi aequante) *d.*
d. Folia ovato-deltoidea vel -oblonga plus minusve hastata saepius acuminata ..... Subsect. 7. BRACHIATAE (p. 59).
d. Folia nullo modo hastata *e.*
e. Folia late ovata saepe suborbicularia vel flabellifomia vel reniformia saepius parva vel minima 5–20 (rarissime usque ad 60) mm. longa. Capitula parva saepe glomerata, pedicellis involucro multo brevioribus rarius (*B. Palmeri* et *B. californica*) elongatis..... Subsect. 8. BACCHARIDEAE (p. 64).
e. Folia majora (2–15 cm. longitudine) proportione longiora ovata vel oblonga vel elliptica. Capitula majora saepius gracilliter pedicellata rarius subsessilia ..... Subsect. 9. COLEOSANTHUS (p. 74).

SUBSECT. 1. **CLAVIGERA** (DC.), SUBSECT. NOV.

Capitula parva vel mediocra 10–20-flora. Corollae purpureae vel albidae, dentibus limbi tubo saepissime pallidioribus extus glandulosis. Pappi setae barbellato-subplumosae (exsiccatione) fulvescentes. — Herbae perennes erectae, basi paullo lignescentes. Folia linearia sessilia alterna margine revoluta. Species 2, mexicanae.

Clavigera DC. Prod. v. 127 (1836), excl. spec. ult.
Brickellia § *Clavigera* (DC.) Gray, Pl. Wright. i. 84 (1852).

CLAVIS SPECIERUM

Inflorescentia thyrsoidea vel subspicato-paniculata. Capitula ca. 10-flora.....14. *B. scoparia.*
Inflorescentia corymbosa. Capitula ca. 20-flora.....15. *B. corymbosa.*

14. B. SCOPARIA (DC.) Gray, Pl. Wright. i. 84 (1852)

Virgata 3–15 dm. alta; caule tereti dense folioso striato puberulo saepius purpureo; foliis linearibus integerrimis supra scabris subtus paullo pallidioribus punctatis 2–6 cm. longis 1–3(–7) mm. latis, costa media subtus prominente albida, venis lateralibus multo minoribus reticulatis; inflorescentia nunc 2–3 dm. longa et 5–10 cm. diametro nunc multo breviore latioreque e racemis multis paniculatim dispositis tamen nunquam vere corymbosa; capitulis 12 mm. altis 3 mm. diametro pedicellos longitudine superantibus; involucri subcylindrici squamis purpurascentibus 3–5-nerviis oblongis apice rotundatis et mucronulatis extus apicem versus glandulosis. (FIG. 14.)

Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881).
Clavigera scoparia DC. Prod. v. 128 (1836).
C. scabra Benth. Pl. Hartw. 19 (1839).
Coleosanthus scoparius (DC.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO: CIVITAT. IGNOT.: in Sierra Madre, *Seemann*, n. 2008 (hb. Gray.). SAN LUIS POTOSI: ad Guascamam, in sierra alta, *Purpus*, n. 4826 (hb. Univ. Calif.). GUANAJUATO: ad Leon, *Mendez* (hb. DC.). JALISCO: in declivitatibus et graminosis, alt. 1372 m., prope Guadalajaram, *Pringle*,

nn. 2159 (hb. Gray.), 2325 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U.S.), 11,493 (hbb. Gray., U. S.); Rio Blanco, *Palmer* (anno 1886), nn. 601 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.), 758 (hb. Gray.); ad Balaños, *Hartweg*, n. 138 (hb. Gray.). MICHOACAN: ad Acambaro, *C. & E. Seler*, n. 1166 (hbb. Gray., N. Y.). TERRITORIUM FOEDERALE: in saxosis origine vulcanicis supra Tlalpam, alt. 2440 m., *Pringle*, n. 9863 (hbb. Gray., Mo., N. Y., U. S.). PUEBLA (?): ad San Andres, *Liebmann*, n. 236 (hb. Gray.). MORELOS: prope Cuernavacam, *Lemmon et ux.*, n. 104 (hbb. Gray., Univ. Calif.). VERA CRUZ: Orizaba, *Botteri*, nn. 510 (hb. Gray.), 612 (hb. Gray.); *Bourgeau*, n. 3345 (hbb. Gray., U. S.). GUERRERO: inter Tlalpam et Ayusinapam, *E. W. Nelson*, n. 2100 (hbb. Gray. U. S.). OAXACA: collibus ad San Juan del Estado, alt. 1890 m., *L. C. Smith*, n. 883 (hb. Gray.); in Sierra de San Felipe, alt. 2135 m., *C. L. Smith*, n. 304 (hbb. Mo., N. Y., U. S.). CHIAPAS: silvis in terra temperata, *Ghiesbreght*, n. 553 (hb. Gray.); ad Santa Cruz, *Rovirosa*, n. 907 (hb. Phil.). GUATEMALA: fide Hemsl. l. c.

FIG. 14. B. scoparia.

Var. *a.* **typica,** foliis basi angustatis. — Synon. et distrib. et exsicc. ut supra dictae.

NOTA. — Hujus varietatis formae vel conditiones duae plus minusve cognoscendae sunt: Forma *a.* **normalis,** inflorescentia spiciformi-thyrsoidea valde elongata. Forma *b.* **ramosior,** forma nov., inflorescentia laxius ramosa saepius latiore quam longa; ramis adscendenti-patentibus 6–10 cm. longis; capitulis ad apices ramorum breviter racemosis. — *Clavigera scoparia* Deless. Ic. iv. t. 12 (1839), non accurate DC. Prod. v. 128 (1836). *Brickellia corymbosa* sched. mult. recent. non *Clavigera corymbosa* DC. — Forma vel conditio quamquam primo aspectu valde differens et saepe pro specie sequente errore interpretata tamen in formam *normalem* facillime transiens ergo solum ejusdem forma inconstans videtur nullo modo ultra recognoscenda.

Var. *β.* SUBAURICULATA Robinson, foliis basi plus minusve expansis vel biauriculatis, aliter var. *typicae* simillima. — Proc. Am. Acad. xlvii. 201 (1911). (FIG. 14 *β.*)

FIG. 15. B. corymbosa.

MEXICO: inter San Luis Potosi et Tampico, *Palmer* (1878–9), n. 1077 (hbb. Gray., Phil., U. S.). ZACATECAS: in collibus, *Pringle*, n. 1766 (hbb. Gray., J. D. Sm., Univ. Calif., Phil., U. S.).

15. B. CORYMBOSA (DC.) Gray, Pl. Wright. i. 84 (1852)

Gracilis 2.5–3 dm. alta; caulibus vel simplicibus vel basi ramosis foliosis; foliis anguste linearibus attenuatis integerrimis basi angustatis uninerviis 2–4 cm. longis superioribus gradatim reductis margine revolutis; inflorescentia laxe corymbosa 6–8 cm. diametro planiuscula 10–25-capitulata, ramis patenti-adscendentibus saepius 2–3-capituliferis; bracteis parvis linearibus; pedicellis 1.5–3.7 cm. longis involucrum longitudine multo superantibus; capitulis ca. 20-floris plerisque erectis ca. 1 cm. diametro; involucri subcampanulati-cylindracei squamis lineari-oblongis conspicue striatis. (FIG. 15.)

Clavigera corymbosa DC. Prod. v. 128 (1836).
Coleosanthus corymbosus (DC.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT.: GUANAJUATO: ad Leon, *Mendez*, anno 1829 (hb. DC., phot. in hb. Gray.). Species ut videtur hucusque nunquam reperta.

SUBSECT. 2. **FRUTESCENTES,** SUBSECT. NOV.

Capitula magnitudine mediocra ca. 26-flora in ramulis terminalia solitaria. Involucri squamae gradatim imbricatae. Receptaculum glabrum. — Frutex xerophyticus patenter ramosissimus. Folia (in axibus maturis) parva pleraque integra spatulato-oblonga basi angustata sessilia. Species unica Californiae aust. et infer. necnon Nevadae incola.

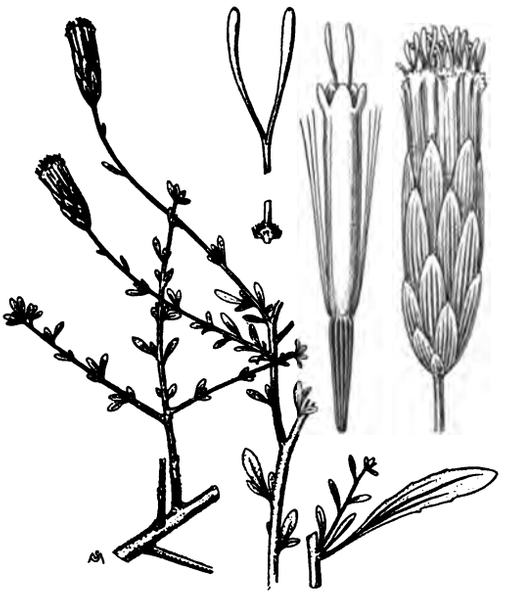

FIG. 16. B. frutescens.

16. B. FRUTESCENS Gray, Proc. Am. Acad. xvii. 207 (1882)

Fruticosa griseo-tomentella intricate ramosissima aromatica; ramis ramulisque foliosis plus minusve rigidis induratisque subpungentibus; cortice pallide griseo saepius sulcatulo; foliis spatulato-oblongis obtusis integris pallide viridibus concoloribus utrinque tomentellis 3–12 mm. longis 1–3.2 mm. latis; pedunculis curvato-adscendentibus 1–3 cm. longis unicapitulatis; capitulis 13 mm. altis 5–6 mm. diametro; involucri squamis oblongo-linearibus saepius 4-nerviis apice rotun-

datis et mucronulatis, extimis apicem versus subherbaceis tomentellis acutatis plus minusve squarrosis; corollis 7.5 mm. longis graciliter tubulatis purpureis; achaeniis 3.3 mm. longis sursum hispidulis. (FIG. 16.)

Gray, Syn. Fl. i. pt. 2, 108 (1884); Hall, Univ. Calif. Pub. Bot. iii. 31 (1907).
Coleosanthus frutescens (Gray) Ktze. Rev. Gen. i. 328 (1891).

NEVADA: ab Cuprite ad occ. spect. alt. 1525 m., *Monnet* (hb. U. S.).

CALIFORNIA: in desertis Colorado dictis, *Purpus* (hb. Univ. Calif.), *K. Brandegee* (hb. Univ. Calif.); ad Palm Spring, *Jones* (hb. U. S.); in colle San Felipe *Jones* (hb. Jns.); San Diego com., *G. R. Vasey*, n. 249 (hbb. J. D. Sm., U. S.), sine numero (hb. Gray.); in jugis siccis ad Jacumbam, *Abrams*, n. 3665 (hbb. Gray., Mo., N. Y., Phil., U. S.).

CALIFORNIA INFER.: ad San Felipe, *Hayes*, n. 349 (hbb. Gray., N. Y., U. S.), *Parish frat.*, n. 1390 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.); in montibus Cantillas, *Palmer* (anno 1875), n. 191 (hb. Gray.), *Orcutt*, n. 1121 (hbb. Gray., Mo., J. D. Sm.); ad Aliso prope San Telmo, *Brandegee* (hbb. Univ. Calif., N. Y., U. S.); ad Santa Maria, *Brandegee* (hb. Univ. Calif.); ad San Fernando, *Brandegee* (hb. Univ. Calif.); secundum rivulum Vallederos, *Brandegee* (hb. Univ. Calif.).

NOTA. — In axibus juvenilibus uberioribus celeriter crescentibus occurrent aliquando folia majora ad 4 cm. longitudine 1 cm. latitudine remote cuspidato-denticulata 3-nervia sparse pubescentia. Vide, e. g., specimen a Parish fratris sub numero 1390 lectum et nunc in hb. J. D. Sm. servatum.

SUBSECT. 3. **MICROPHYLLAE**, SUBSECT. NOV.

Capitula parva vel mediocra 10–25-flora erecta vel patentia. Involucri squamae valde inaequales, interiores lineari-oblongae 3–4-striatae, exteriores gradatim breviores apice subherbaceae saepe subtridentatae vel paullo angulatae plus minusve squarrosae. Receptaculum glabrum. Folia parva suborbiculari-ovata vel ovato-oblonga dentata sessilia vel breviter petiolata. — Fruticosae vel frutescentes xerophyticae species 4 arcte affines in montuosis et planitiebus aridis Am. Bor. occ. et ins. Cedros incolae.

CLAVIS SPECIERUM

a. Involucri squamae intermediae integrae. Folia niveo-lanata. Calif. aust..... 17. *B. Nevinii.*
a. Involucri squamae intermediae apice plus minusve 3-dentato-angulatae. Folia pallide viridia tomentella vel glandulari-puberula *b.*
b. Caules pedicellique patenter glandulari-villosi. Capitula (ca. 13 mm. alta) 20–24-flora. Achaenia 4–4.5 mm. longa. Ore., Nev. occ., Calif., Cedros Ins..... 18. *B. microphylla.*
b. Caules pedicellique arcte lanulati. Capitula (ca. 11 mm. alta) ca. 18-flora. Achaenia ca. 3.5 mm. longa. Utah, Nev. aust.-or., Calif. aust.-or..... 19. *B. Watsonii.*
b. Caules pedicellique brevissime patenterque glandulari-puberuli. Capitula (ca. 11 mm. alta) 10–12-flora. Achaenia ca. 3.5 mm. longa. Wyo. aust., Colo., Neo-Mex., Ariz. bor., Utah aust., Nev..... 20. *B. scabra.*

17. B. NEVINII Gray, Proc. Am. Acad. xx. 297 (1885)

Basi lignescens procumbens; ramis erectis 3–4 dm. altis inferne simplicibus apicem versus racemose vel paniculatim ramosis; foliis ovatis crenato-serratis

obtusis basi rotundatis vel subcordatis niveo-lanatis ca. 1 cm. longis; capitulis ramos patenter adscendentes bracteato-foliosos singulatim vel binis vel ternis terminantibus 15 mm. altis 5.8 mm. diametro ca. 23-floris; involucri squamis ca. 30 albo-lanatis 3–4-nerviis obtusiusculis, extimis paullo in pedicellum errantibus squarrosis; corollis 7.5 mm. longis albidis vel purpureo-tinctis; achaeniis 4 mm. longis in costis sursum paullo hispidulis; pappi setis ca. 20 sublaevibus. (Fig. 17.)

Gray, Syn. Fl. i. pt. 2, suppl. 445 (1886); Hall, Univ. Calif. Pub. Bot. iii. 31 (1907).
Coleosanthus Nevinii (Gray) Heller, Cat. N. A. Pl. 8 (1898).

CALIFORNIA AUST.: Los Angeles com. in montibus Newhall, *Nevin* (hbb. Gray., Univ. Calif., Phil.); in saxosis caespites densos formans prope Claremont, *Baker*, n. 3731 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); in jugo Santa Monica supra Sherman, *Greata*, n. 331 (hbb. Gray., Mo., Univ. Calif., U. S.), *Braunton*, nn. 17 (hb. U. S.), 517 (hbb. Univ. Calif., N. Y., U. S.); in collibus siccis ad Pasadenam, *McClatchie* (hb. N. Y.).

Nota 1. — Fide cl. Grayi, ll. cc., capitula hujus speciei 30–40-flora sunt; tamen flosculi caute repetiteque numerati (etiam apud specimen typicum) ca. 23 videntur.

Nota 2. — Involucri squamae extimae non nunquam numerosissimae et in folia ramea gradatim transiunt. Videtur forma inconstans, e. g., pl. leg. ad Sherman, *Braunton*, n. 517 (hb. Univ. Calif.).

Fig. 17. B. Nevinii.

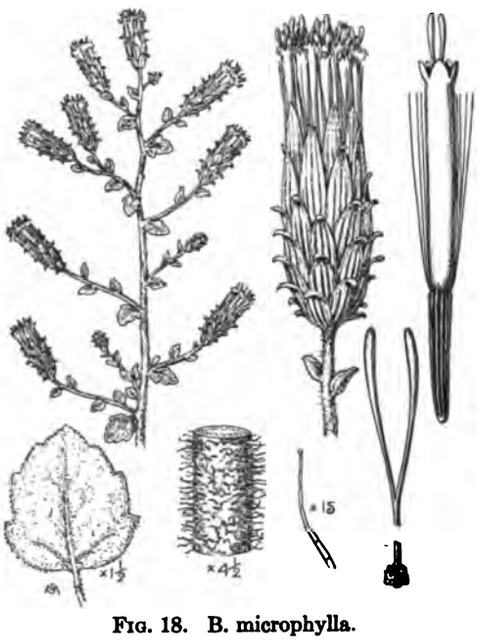

Fig. 18. B. microphylla.

18. B. microphylla (Nutt.) Gray, Pl. Wright. i. 85 (1852)

Fruticosa a basi ramosissima patenter glandulari-villosa et viscida 4–6 dm. alta; ramis tenuibus adscendentibus superne foliosis inferne delapsu foliorum saepe plus minusve nudatis; foliis suborbiculari-ovatis 1–2 cm. longis 9–16 mm. latis pauci-

dentatis acutiusculis concoloribus pallide viridibus utrinque breviter tomentosis basi rotundatis breviter petiolatis, rameis gradatim minoribus subsessilibus; capitulis ad apices ramulorum saepissime brevium subdivaricate patentium solitariis vel saepe 2–7 aggregatis ca. 22-floris; involucri squamis ca. 45 apice herbaceis; corollis gracillime tubulatis ochroleucis saepius in uno latere purpureo-tinctis; achaeniis 4–4.5 mm. longis griseo-brunneis in costis sursum hispidulis; pappi setis obscure barbellatis. — In collibus et montuosis calcareis aridis, Am. Bor. occ. (FIG. 18.)

Gray, Syn. Fl. i. pt. 2, 106 (1884) excl. pl. colo., & Bot. Calif. i. 300 (1876) quoad pl. calif.
Bulbostylis microphylla Nutt. Trans. Am. Phil. Soc. ser. 2, vii. 286 (1841).
Brickellia cedrosensis Greene, Bull. Torr. Bot. Club, x. 86 (1883).
Coleosanthus microphyllus (Nutt.) Ktze. Rev. Gen. i. 328 (1891).
Coleosanthus cedrosensis Greene, Erythea, i. 54 (1893).
Brickellia Grayana Hieron. in Engl. Bot. Jahrb. xxviii. 583 (1901).

OREGON OR.: in montibus Blue nominatis, *Nuttall* (hb. Gray.); prope flumen Snake nominatum, *Cusick*, sine numero anno 1882 (hb. Gray), n. 2121 (hbb. Gray., Mo., Univ. Calif., U. S.).

IDAHO: ad urbem Boise, *Wilcox* (hb. Gray.); ad locum anglice Blue Lakes dictum, *Palmer* (anno 1893), n. 528 (hb. U. S.).

NEVADA: ad trajectum fluminis Quin, *Griffiths & Morris*, n. 377 (hb. U. S.); in desertis anglice Black Rock dictis, *Griffiths & Hunter*, n. 529 (hbb. N. Y., U. S.); in jugo orientali montium Humboldt, *Torrey*, n. 199 (hbb. Gray., Mo., U. S.); secundum rivulum Smoke dictum, *Griffiths & Hunter*, n. 506 (hb. U. S.); ad Pyramid, *K. Curran* (hb. Univ. Calif.); ad Candelariam, alt. 1983 m., *Shockley*, n. 309 (hbb. Gray., U. S.); ad Reno, *Hillman* (hb. Jns.); Storey com. ad valliculam praeruptam Hermit's Cañon dictam, alt. 1464 m., *Kennedy*, n. 1954 (hbb. Gray., Univ. Calif., Univ. Wyo., N. Y., U. S.); rupibus montium Alborum, alt. 1525–1830 m., *Purpus*, n. 6426 (hbb. Univ. Calif., N. Y., U. S.).

CALIFORNIA: Sierra com., *Lemmon*, n. 116 (hbb. Phil., U. S.); prope lacum Tahoe, *Lemmon*, n. 1107 (hb. Gray.); prope Lundy, Mono com., *M. Minthorn* (hb. Univ. Calif.), *Austin*, n. 309 (hb. Univ. Calif.).

INSULA CEDROS: *Veatch* (hb. Gray.).

19. **B. Watsonii**, spec. nov.

Praecedenti habitu foliisque similis; caulibus pedicellisque molliter lanulatis vel crispe puberulis, pilis tenuibus curvatis vel flexuosis plus minusve implexis; ramulis capituliferis ut apud praecedentem subdivaricati-patentibus tamen plerumque brevibus; capitulis ca. 18-floris ca. 11 mm. altis; achaeniis 3.4–3.5 mm. longis. (FIG. 19.)

B. microphylla Wats. Bot. King Exped. 138 (1871), quoad pl. utahensem, non Grayi.

UTAH: In montibus Wasatch, *Tidestrom*, n. 559 (hb. U. S.); Salt Lake com., prope fontes calidos Beck's dicatos, *Garrett*, nn. 2064 (hb. Univ. Wyo.), 2188 (hb. Gray.); ad ostiam vallis praeruptae American Fork Cañon nominatae, alt. 1525–1830 m., *Watson*, n. 494 (hbb. Gray., U. S. ubi etiam sarmenta vegetiva nonnulla foliis tenuioribus argutius dentatis); ad Marysvale, alt. 1982 m., *Jones*,

n. 5972 (hbb. Mo., Univ. Calif., N. Y., U. S., Jns.); ad Fish Spring, *Jones* (hb. Jns.); ad Black Rock, *Jones*, n. 1467 (hbb. U. S., Arn. Arb., Gray.); ad Milford, *Jones* (hb. Jns.); ad lacum Spring, *Parry* (anno 1875), n. 18 (hb. Gray.); ad St. George, *Palmer* (anno 1875), sine numero (hb. Mo.); sine loco exactiore, *Parry*, n. 37 (hbb. Mo., Phil.).

NEVADA AUST.–OR.: rupibus montium Highland nominatorum, alt. 1525–1830 m., *Purpus*, n. 6286 (hbb. Univ. Calif., U. S.); in montibus Charleston, *Jones* (hb. Jns.).

CALIFORNIA AUST.–OR.: in montibus Providence, *Brandegee* (hb. Univ. Calif.).

FIG. 19. B. Watsonii.

20. B. SCABRA (Gray.) Nels. Man. Bot. Rocky Mts. 487 (1909) in syn. (*scaber*).

Habitu duabus praecedentibus similis ramosior brevissime patenterque glandulari-puberula et scabrida vix viscida; foliis paullo minoribus, caulinis 8–12 mm. longis, rameis numerosis gradatim reductis quam internodiis saepius multo brevioribus; ramis ramulisque floriferis gracilibus elongatis adscendentibus vel suberectis plerisque 1–2-capitulatis; capitulis ca. 11 mm. altis 10–12-floris plerumque terminalibus conjunctim in paniculam amplam laxe dispositis; involucri squamis ca. 30; corollis ochroleucis saepe uno latere purpureo-tinctis; achaeniis ca. 3.5 mm. longis; pappi setis albis breviter barbellatis. (FIG. 20.)

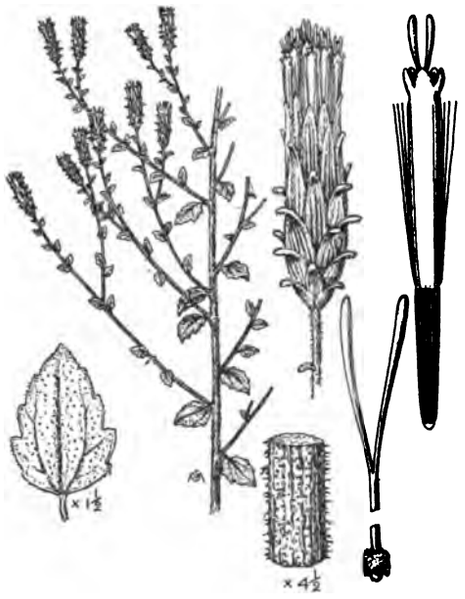

FIG. 20. B. scabra.

B. microphylla, var. *scabra* Gray, Proc. Am. Acad. xi. 74 (1875–6), & Syn. Fl. i. pt. 2, 106 (1884).
Coleosanthus scaber (Gray) Greene, Pittonia, iii. 100 (1896); Rydberg, Fl. Colo. 336 (1906).
B. microphylla Nels. l. c. quoad pl. montium scopulorum.

WYOMING AUST.: Sweetwater com., ad locum "The Gap" anglice nominatum, *A. Nelson*, n. 3594 (hb. Univ. Wyo.).

COLORADO OCC.: ad fontes Glenwood, Garfield com., *Osterhout*, n. 3400 (hbb. Gray., Univ. Wyo., N. Y.); ad Grand Junction, *Greene* (hb. U. S.); ad Deer Run, alt. 1433 m., *Baker*, n. 908 (hbb. Gray., Mo., Univ. Wyo., Univ. Calif., N. Y., U. S.); in collibus petrosis ad Naturitam, alt.

1647 m., *Payson*, n. 594 (hbb. Gray., Mo.); ad New Castle, *Robbins*, n. 6982 (hb. Univ. Wyo.); ad Mancos Cañon, *Brandegee*, n. 1133 (hbb. Univ. Calif., Mo.); sine numero (hb. Mo.); ad Mesa Verde, *Brandegee* (hbb. Gray., U. S.), *Eastwood* (hbb. Univ. Calif., U. S.).

NEO–MEXICO: prope Farmington, San Juan com., alt. 1550 m., *Standley*, n. 7122 (hb. U. S.), *Wooton*, n. 2605 (hb. U. S.).

ARIZONA BOR.–OR.: in parte boreali montium Carrizo, *Standley*, n. 7354 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); in vallicula praerupta de Chally dicta, *Griffiths*, n. 5863 (hb. U. S.).

UTAH: in valle Duchesne, alt. 1525 m., *Jones* (hb Jns.); ad Moab et vicin., *Jones* (hbb. Jns., Gray.), *Rydberg & Garrett*, nn. 8351 (hb. N. Y.), 8419 (hb. N. Y.); secundum flumen San Juan, alt. 1200–1500 m., *Rydberg & Garrett*, n. 9881 (hbb. Univ. Calif., N. Y., U. S.); ad rivulum Capitol Wash dictum, *Jones*, n. 5701b (hbb. U. S., Jns.); ad Marvine Laccolite, *Jones*, n. 5663z (hbb. U. S., Jns.); supra Kanab, *Jones*, n. 6047e (hbb. U. S., Jns.); supra Springdale, *Jones*, n. 6080g (hbb. U. S., Jns.).

NEVADA: in saxosis prope Cuprite, Esmeraldo com., *Monnet* (hb. U. S.); prope Rhyolite, alt. 1158 m., *Jones* (hb. Jns.); ad Caliente, *Jones*, n. 12,050 (hbb. Jns., Gray.) capitulis paullo majoribus ca. 18-floris forma dubia.

Subsect. 4. **PARVULAE**, Subsect. Nov.

Capitula parva vel mediocra 10–14-flora. Involucri squamae valde inaequales regulariter imbricatae adpressae. Folia lanceolata vel ovato-lanceolata vel rarius ovata semper infra medium latissima basi angustata vel rarius subtruncata nunquam cordata. — Spec. 4, Civ. Foed. aust.-occ. incolae.

Clavis specierum

a. Achaenia subglabra fusco-grisea. Capitula subspicata. Folia alterna internodiis multo longiora ..... 21. *B. dentata.*

a. Achaenia dense villoso-hirsutula. Capitula laxius disposita. Folia saltem inferiora saepissime opposita *b.*

b. Involucri squamae paucae (ca. 14) dorso pubescentes. Fruticulosa basi ramosissima. Capitula longe pedunculata corymbosa ..... 22. *B. parvula.*

b. Involucri squamae numerosiores margine saepius conspicue ciliatae dorso glabriusculae. Herbae perennes. Inflorescentia plus minusve elongata racemosa vel paniculata *c.*

c. Folia tenuia scabrido-puberula neque rugosa nec reticulata. Pappi setae longiuscule subplumosae ..... 23. *B. brachyphylla.*

c. Folia subcoriacea reticulato-venosa pubescentia. Pappi setae vix scabridae 24. *B. cylindracea.*

21. B. dentata (DC.) Sch. Bip. in Seem. Bot. Herald. 301 (1856), solum quoad syn. nominiferum.

Erecta 6–12 dm. alta; caulibus pluribus a radice perennante pallide griseis teretibus inferne simplicibus et delapsu foliorum mox nudatis superne fastigiatim ramosis foliosissimis; foliis lanceolatis vel anguste ovatis acutis 3-nerviis obtuse dentatis vel subintegris pallide viridibus concoloribus puncticulatis plus minusve

pubescentibus mox glabrescentibus 2–3.2 cm. longis 6–12 mm. latis saepius adscendentibus et imbricatis; capitulis subsessilibus foliaceo-bracteatis ca. 1.4 cm. altis 3.8 mm. diametro ca. 14-floris; involucri squamis lateraliter late scarioso-marginatis ciliatis dorso 3-nerviis pubescentibus; corollis 6 mm. longis ut videtur albis; achaeniis 4.7 mm. longis solum apicem versus paullulo hispidulis; pappi setis ca. 33 barbellatis. (FIG. 21.)

Clavigera dentata DC. Prod. v. 128 (1836).
C. Riddellii Torr. & Gray, Fl. ii. 77 (1841).
Brickellia Riddellii (Torr. & Gray) Gray, Pl. Wright. i. 83 (1852), & Syn. Fl. i. pt. 2, 108 (1884).
Coleosanthus dentatus (DC.) Ktze. Rev. Gen. i. 328 (1891).
C. Riddellii (Torr. & Gray) ["Ktze."] Small, Fl. S. E. U. S. 1177 (1903).

TEXAS: ad Bejar, *Berlandier*, nn. 513 (hbb. DC., Gray.), 669 (hbb. DC., Gray., Phil.), 1893 (hbb. Gray., Mo.), 2079 (hb. Gray.); secundum Rio Grande, *Wright* (hb. Gray.); in sabulosis secundum flumen Pedernales, *Lindheimer*, n. 438 (hbb. Mo., Phil.); ad fontem Comanche et prope Neo-Braunfels, *Lindheimer*, nn. 191 (hbb. Gray., Mo.), 409 (hbb. Gray., Mo., Phil., U. S.), 890 (hbb. Gray., Mo., N. Y., Phil., U. S.), 891 (hbb. Gray., Mo., N. Y., Phil., U. S.); ad Georgetown, Williamson com., *Palmer* (anno 1879), n. 448 (hbb. Mo., J. D. Sm., U. S.); ad Uvalde, *Palmer* (anno 1880), n. 449 (hb. J. D. Sm., Phil., U. S.), *Bodin*, n. 173 (hb. U. S.); secundum flumen Frio, *Bigelow* (hb. Gray.); sine loco exactiore, *Riddell* (hb. Gray.).

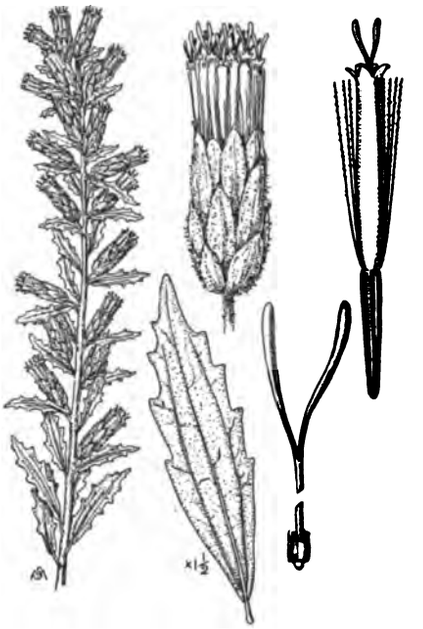

FIG. 21. B. dentata.

FIG. 22. B. parvula.

22. B. PARVULA Gray, Pl. Wright. i. 84 (1852)

Fruticulosa basi ramosissima 12–30 cm. alta puberula; ramis gracilibus curvato-adscendentibus foliosis; foliis ovatis acutis serratis basi subtruncatim angustatis plerisque oppositis 9–15 mm. longis 6–10 mm. latis utrinque scabro-puberulis; corymbis terminalibus 3–10-capitulatis; pedicellis gracilibus usque ad 3.5 cm. longis; capitulis erectis 11 mm. altis 5.6 mm. diametro ca. 12-floris; involucri squamis paucis (ca. 14) laxe imbricatis ca. 3–5-striatis angustis mucronulatis dorso pubescentibus; corollis 5.7 mm.

longis; styli ramis clavatis; achaeniis hirsutis; pappi setis obscure barbellatis ca. 35. — Species texensis rarissima. (FIG. 22.)

Gray, Syn. Fl. i. pt. 2, 107 (1884).
Coleosanthus parvulus (Gray) Ktze. Rev. Gen. i. 328 (1891).

TEXAS OCC.: ultra (i. e. ad solum occidentem spectans) angustias Limpia, *Wright*, n. 249 (hbb. Gray., Mo., Columb. Univ., Phil., U. S.). Species hucusque ut videtur nunquam reperta sequenti proxima sed verisimiliter distincta.

23. B. BRACHYPHYLLA Gray, Pl. Wright. i. 84 (1852)

Gracilis puberula pluricaulis a caudice paullo lignescente; caulibus erectis inferne simplicibus superne racemose vel paniculatim ramosis; foliis lanceolatis vel anguste ovatis acutis leviter et subdistanter serratis vel integriusculis basi angustatis 1–4 cm. longis 4–12 mm. latis 3-nerviis tenuibus; inflorescentia laxa plerumque elongata racemosa vel pyramidale paniculata; capitulis ca. 1 cm. altis 4 mm. diametro ca. 9-floris; involucri squamis 16–17 argute acuminatis 5–7-striatis ciliolatis dorso vix hirtellis; corollis 5.5 mm. longis; achaeniis hirsutulis; pappi setis breviter sed distincte plumosis. — In collibus montuosisque Civ. Foed. aust.-occ. frequens. (Fig. 23.)

FIG. 23. B. brachyphylla.

Gray, Syn. Fl. i. pt. 2, 108 (1884).
Clavigera brachyphylla Gray, Pl. Fendl. 63 (1849).
Coleosanthus brachyphyllus (Gray) Ktze. Rev. Gen. i. 328 (1891).

TEXAS OCC.: in montibus Guadalupe, *Havard*, n. 67 (hbb. Gray., Mo.); in regione Llano Estacado hispanice dicta, *Bigelow* (hb. Gray.).

COLORADO AUST.-OCC.: ad Mesa Verde, *Eastwood* (hbb. Mo., Univ. Calif.).

NEO-MEXICO: in collibus vulcanicis, Sierra com., *Standley*, n. 6082 (hb. U. S.), in collibus siccis prope Dulca, *Standley*, n. 8219 (hb. U. S.); in loco Plaza Larga hispanice dicto, *Bigelow* (hb. U. S.); prope flumen Mora, *Fendler*, nn. 303 (hbb. Gray., Mo.), 339 (hbb. Gray., Mo.); ad Cerrillas, *Herrick*, n. 780 (hb. U. S.); in montibus Mimbres, *Greene*, n. 235 (hb. Gray.); in valliculis umbrosis ad fontes rivuli St. Vincent's, *Greene* (hbb. Gray., Mo., Phil., Jns.); prope urbem Silver nominatam, *Holzinger* (hbb. Mo., U. S.); collibus siccis montium Sandia, alt. 2135 m., *Ellis*, n. 385 (hbb. Mo., U. S.); in montibus Burro, *Rusby*, n. 240½ (hb. Gray.); ad Wagon Mound, *Pringle* (hb. J. D. Sm.); in montibus Albis, Lincoln com., alt. 1680 m., *Wooton*, n. 384 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.); ad fontes Mangas, alt. 1450 m., *Metcalfe*, n. 733 (hbb. Gray., Mo., N. Y., U. S.); in

montibus Mogollon, alt. ca. 2300 m., *Metcalfe*, n. 387 (hbb. Gray., Mo., N. Y., U. S., Jns.); secundum ramum medium fluminis Gila in montibus Mogollon, *Wooton* (hb. U. S.); in montibus ab Santa Rita ad bor. spect., *Wooton* (hb. U. S.); ad Kingston, Sierra com., alt. 2013 m., *Metcalfe*, n. 1401 (hbb. Mo., U. S.); in montibus El Capitan, alt. 2135 m., *Earle*, nn. 396 (hbb. Mo., N. Y., U. S.), 568 (hbb. Mo., N. Y., U. S.) forma uberior foliis majoribus ad 6 cm. longis et 2.4 cm. latis.

ARIZONA AUST.: sine loco exactiore, *Lemmon*, n. 314 (hb. Gray.); ad Coronado, Clifton, *Davidson*, n. 389 (hb. Univ. Calif.).

24. B. CYLINDRACEA Gray & Engelm. Proc. Am. Acad. i. 46 (1848)

Breviter griseo-pubescens a basi herbacea; caulibus saepius simplicibus erectis 6–12 dm. altis foliosis tomentellis; foliis lanceolatis vel ovato-oblongis subcoriaceis crenato-serratis basi cuneatis vel rotundatis brevissime petiolatis subtus tomentellis reticulato-venosis paullo pallidioribus, caulinis 2–6 cm. longis 12–30 mm. latis; capitulis in racemum vel paniculam thyrsoideam vel laxiorem foliaceo-bracteatam dispositis ca. 10-floris; involucri squamis plerumque numerosis (usque ad 43) argute acuminatis 5–9-striatis, exterioribus eleganter ciliatis; receptaculo parce hirtello; corollis purpureis 6 mm. longis; achaeniis hirsutulis 5 mm. longis; pappi setis ca. 30 sublevibus. — In fruticetis saxosis aridis. Tex. et Mex. bor. (FIG. 24.)

Gray, Pl. Lindh. ii. 218 (1850), & Syn. Fl. i. pt. 2,107 (1884).
Coleosanthus cylindraceus (Gray & Engelm.) Ktze. Rev. Gen. i. 328 (1891).
Brickellia cylindrica Greenman, Field Columb. Mus. Bot. Ser. ii. 265 (1907), sphalm.

FIG. 24. B. cylindracea.

TEXAS OCC.: secundum partem superiorem fluminis Guadalupe, *Lindheimer*, nn. 439 (hbb. Gray., Mo.), 412 (hbb. Gray., Mo., Phil., U. S.); ad fontes Leon, *Jermy*, n. 49 (hb. Brown Univ.); collibus prope Friedrichsburg, *Lindheimer*, n. 467 (hbb. Gray., Mo.); ad fontem Comanche vel prope Neo-Braunfels, *Lindheimer*, n. 889 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.); in dumetis ad Neo-Braunfels, *Lindheimer*, n. 7 (hb. Mo.); ad Comancheries orientales, *Berlandier*, nn. 508 (hbb. Gray., Phil.), 1833 (hb. Gray.); ad Georgetown, Williamson com., *Bodin*, n. 174 (hb. U. S.); ad Bluffton, *Palmer* (1879–80), n. 445 pro parte (hbb. Gray., Mo.); sine loco exactiore, *Wright*, n. 250 (hbb. Gray., U. S.).

MEXICO BOR.: COAHUILA: in Sierra de Parras, *Purpus*, n. 4716 (hbb. Gray., Field Mus., Univ. Calif., U. S.); Sierra de la Paila, *Purpus*, nn. 4725 (hb. Univ. Calif.), 4728 (hb. Mo.).

Var. *α.* **typica,** inflorescentia racemiformi vel thyrsoidea elongata; involucri basi turbinati squamis numerosis (30–43) deorsum in pedicellos quasi decurrentibus. — Distrib. et synon. et exsicc. ut supra dictae. (FIG. 24.)

Var. *β.* LAXA Gray, inflorescentia ramosior laxe paniculata pyramidata; involucri vix basi turbinati squamis paucioribus (saepius ca. 25) in pedicellos non errantibus. — Proc. Am. Acad. xvii. 207 (1882), & Syn. Fl. i. pt. 2, 108 (1884).

TEXAS: ad Georgetown, *Palmer* (1879–80), n. 446 (hbb. Gray., Mo., J. D. Sm., U. S.); ad Bluffton, *Palmer* (anno 1879–80), n. 445 pro parte (hbb. Gray., J. D. Sm., Phil., U. S.); dumetis prope flumen Blanco, *Bigelow* (hb. Mo.).

SUBSECT. 5. **RETICULATAE,** SUBSECT. NOV.

Capitula mediocra 10–24-flora in racemos folioso-bracteatos vel paniculas laxiusculas pyramidales vel rare subcorymbose disposita. Involucri squamae regulariter pluriseriatim imbricatae. Folia oblonga vel rarius lanceolato-oblonga vel linearia semper multoties longiora quam lata sessilia vel brevissime petiolata. — Species 7, pleraeque mesophyticae neo-mexicanae et arizonicae et mexicanae, una etiam guatemalensis.

CLAVIS SPECIERUM

a. Involucri squamae paucae (14–15) tenues ..... 25. *B. Lemmoni.*
a. Involucri squamae numerosiores (21–37) saepius firmiusculae *b.*
  b. Capitula aut omnia aut nonnulla graciliter pedicellata. Pedicelli nudi vel cum bracteolis paucis (1–3) rarius (apud *B. oliganthem*) pluribus instructi *c.*
    c. Fruticosae. Folia pleraque linearia. Involucri squamae exteriores suborbiculares apice subtruncatae vel etiam paullo retusae et argute mucronulatae ..... 26. *B. venosa.*
    c. Herbae perennes vel suffruticosae. Folia oblonga vel elliptica. Involucri squamae exteriores ovato-oblongae saepius acutae vel acuminatae rare obtusiusculae et mucronulatae *d.*
      d. Folia aut omnia aut nonnulla a media parte ad apicem subdistanter serrata ..... 27. *B. oliganthes.*
      d. Folia integerrima ..... 28. *B. reticulata.*
  b. Capitula subsessilia. Pedicelli aut nulli aut pluri-bracteolati *e.*
    e. Folia subtus pallide viridia griseo-pubescentia. Capitula 17–18 mm. alta 14–24-flora subspicatim racemosa vel saepius in paniculam pyramidalem disposita *f.*
      f. Involucri squamae omnes acutae dorso pubescentes viridi-purpurascentes ..... 29. *B. verbenacea.*
      f. Involucri squamae obtusiusculae dorso glabrescentes substramineae crassiusculae ..... 30. *B. Pringlei.*
    e. Folia subtus albido-tomentulosa. Capitula 12–14 mm. alta ca. 12-flora in paniculam subcorymbosam foliosam disposita subsessilia ..... 31. *B. Kellermanii.*

25. B. LEMMONI Gray, Proc. Am. Acad. xvii. 206 (1882)

Herbacea 3–5 dm. alta crispe griseo-puberula; caulibus pluribus erectis e caudice lignescente crassiusculo orientibus teretibus foliosis inferne simplicibus superne ramosis; foliis anguste lanceolato-oblongis oppositis vel saepe alternis serratis obtusis utrinque molliter vel scabriuscule puberulis 2–4.6 cm. longis 7–14 mm. latis paullo supra basin 3-nerviis subtus reticulato-venosis; panicula primo spiciformi vel racemiformi maturitate evolutiore elongata graciliter conica; ramis adscendentibus 1–3(–5)-capituliferis; capitulis ca. 14 mm. alta 4 mm. diametro subcylindricis ca. 10-floris; involucri squamis 5–7-striatis saepius purpureis, interioribus linearibus acutis vel attenuatis, exterioribus gradatim brevioribus, extimis ovato-lanceolatis acuminatis ciliatis et dorso pubescentibus; receptaculo obscure hirtello; corollis 8 mm. longis pallide flavidis; achaeniis 3 mm. longis fuscescentibus albo-villosis; pappi setis albis ca. 43 capillaribus vix barbellatis. — In montuosis et terris petrosis, Civ. Foed. aust.-occ. et Mex. bor. (FIGG. 25, 26.)

FIG. 25. B. Lemmoni.

FIG. 26. B. Lemmoni, var. Wootoni.

Gray, Syn. Fl. i. pt. 2, 107 (1884).
Coleosanthus Lemmonii [Gray] Ktze. Rev. Gen. i. 328 (1891).
C. Lemmoni (Gray) Heller, Cat. N. A. Pl. 135 (1898).

ARIZONA AUST.: in montibus Chiricahua, *Lemmon*, n. 306 (hbb. Gray., Univ. Calif.), sine numero (hb. Mo.); in terris a petra rhyolitica decomposita ortis ad locum Shelter Cove anglice dictum, alt. 1830 m., *Blumer*, n. 1786 maxima ex parte (hbb. Gray., Mo., N. Y., U. S.).

MEXICO BOR.: CHIHUAHUA: ad Pilares, *Hartman*, n. 775 (hbb. Gray., U. S.); in vallicula praerupta Guayanopa, alt. 1525 m., *Jones* (hbb. Gray., Mo.); ad coloniam Juarez in montibus Madre, *Jones* (hb. Jns.).

Var. *a.* **typica,** caulibus superne ramosis; panicula (primo racemiformi) bene evoluta graciliter conica; pedicellis gracilibus 3–12 mm. longis; foliis saepius con-

duplicatis falcatis patenter reflexis. — Synon. et distrib. et exsicc. ut supra dictae. (FIG. 25.)

Var. β. **Wootoni** (Greene), comb. nov., caulibus plerisque virgatis; capitulis saepissime subsessilibus quasi folioso-spicatis; pedicellis 2–6(–10) mm. longis; foliis plerisque planis; bracteis capitula plerumque superantibus. (FIG. 26.)

Brickellia oliganthes, var. *crebra* Gray ex Pringleo, Pl. Mex. 1885 (nomen); Greene, Pittonia, iv. 126 (1900) in synon.
Coleosanthus Wootoni Greene, Bull. Torr. Bot. Club, xxiv. 511 (1897).
C. densus Greene, Pittonia, iv. 126 (1900).

NEO-MEXICO: in montibus Organ, Dona Ana com., *Wooton* (hbb. Univ. Calif., U. S., Jns.), *Wooton & Standley* (hbb. N. Y., U. S.); in declivitate ad aust. spect., alt. 1677 m., prope Hillsboro, Sierra com., *Metcalfe*, n. 1509 (hbb. Gray., Mo., N. Y., U. S., Jns.); ad locum Lake Valley anglice dictum, Sierra com., *Beals* (hb. U. S.); in montibus Florida, alt. 1626 m., *Jones* (hb. Jns.).

MEXICO BOR.-OCC.: CHIHUAHUA: in collibus petrosis prope urbem Chihuahuam, *Pringle*, nn. 635 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.), 947 (hb. Mo.); basi orientali montium Sierra Madre, *E. W. Nelson*, n. 6502 (hbb. Gray., U. S.,). Varietas ab var. *typica* nullo modo definite disjunguenda.

26. **B. venosa** (Wooton & Standley), comb. nov.

Fruticosa 6–8 dm. vel ultra alta patenter ramosa griseo-puberula vel -tomentella; foliis oppositis patentibus anguste oblongis vel linearibus 2.5–5.5 cm. longis 2–9 mm. latis obtusis a media parte subdistanter serratis basi integris angustatis subtus reticulatis; paniculae laxae ramis nudiusculis; capitulis ca. 11 mm. altis 6.5 mm. diametro ca. 24-floris graciliter pedicellatis erectis; involucri subcampanulati-cylindrici squamis ca. 25 pluriseriatim imbricatis 6–7-striatis saepe purpureo-tinctis, exterioribus gradatim brevioribus latis saepe suborbicularibus apice plus minusve retusis et abrupte arguteque mucronulatis pubescentibus; receptaculo glabro; corollis 6.2 mm. longis pallide flavidis limbum versus plus minusve purpureis; achaeniis sericeis; pappi setis ca. 38. — Civ. Foed. aust.-occ. et Mex. bor.-occ. praecipue in montuosis et locis calcareis. (FIG. 27.)

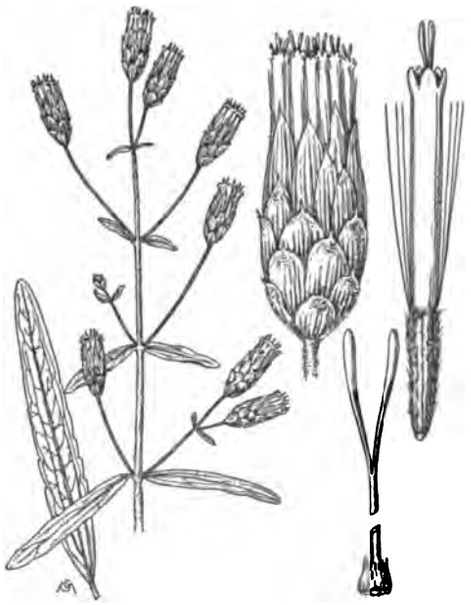

FIG. 27. B. venosa.

Brickellia oliganthes Gray, Pl. Wright. ii. 71 (1853), & Syn. Fl. i. pt. 2, 107 (1884) quoad pl. bor. mex. et ariz. non quoad synon. nominifer.
Coleosanthus venosus Wooton & Standley, Contrib. U. S. Nat. Herb. xvi. 177 (1913).

NEO-MEXICO: in montibus Florida, alt. 1616 m., *Jones* (hb. Jns.); in loco Lake Valley anglice dicto, *Beals* (hb. U. S.); ad urbem Silver nominatam, *Greene* (hbb. Mo., Univ. Calif., Phil., Jns.); in montibus Burro, *Rusby*, sine numero (hb. U. S.); ad fontes Mangas, Grant com., alt. 1430 m., *Metcalfe*, n. 653 (hbb. Gray., Mo., N. Y., U. S.).

ARIZONA: in parte australi, *Lemmon*, n. 308 (hb. Gray.); in collibus calcareis circum Portal, *Eggleston*, n. 10,981 (hb. U. S.); ad Metcalf, *Davidson*, n. 203 (hb. U. S.); in montibus Chiricahua, in valle Rucker dicta et ad angustias Apache, *Lemmon et ux.*, n. 364 (hbb. Gray., Univ. Calif.); ad Shelter Cove, *Blumer*, n. 1786 minima ex parte (hb. Gray.); calcareis in monte Maxon's Peak anglice nominato, *Blumer*, n. 1750 (hbb. Gray., Mo., N. Y., U. S.); ad Bisbee, *Mearns*, n. 1008 (hb. U. S.); declivitatibus petrosis ad fontes Walnut in montibus anglice Mule dictis, *Goodding*, n. 481 (hbb. Gray., N. Y.); in reservatione foederali Santa Rita, *Griffiths*, n. 5943 (hbb. Mo., U. S.); ad Bowie, *Jones* (hb. U. S.).

MEXICO BOR.-OCC.: SONORA: in collibus petrosis prope Santa Cruz, *Thurber*, n. 938 (hb. Gray.), *Wright*, n. 1135 (hbb. Gray., Mo., Phil., U. S.); ad Hermosillo, *Crawford* (hb. Gray.); in montibus San José, *Mearns*, n. 1058 (hb. U. S.). CHIHUAHUA: prope urbem ita nominatam, *Pringle*, nn. 112 (hb. Gray.), 350 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., Phil., U. S., Arn. Arb.), 1021 (hb. Mo.); ad coloniam Juarez in montibus Sierra Madre, *Jones* (hb. Jns.).

NOTA. — Species a sequente dubitative distincta nullis ab characteribus exactis ut videtur absolute distinguenda tamen a foliis angustioribus griseoribus habitu lignescentiore inflorescentia patentius ramosa saepissime faciliter cognoscenda, distributione praeterea longe ad boreali-occidentem in regionem multo siccatiorem vergens.

27. B. OLIGANTHES (Less.) Gray, Pl. Wright. i. 84 (1852), neque ii. 71 (1853) nec. Syn. Fl. i. pt. 2, 107 (1884)

Herbacea erecta crispe puberula 3–8 dm. alta; caulibus virgatis vel saepe superne subcorymboso-ramosis foliosis, internodiis folia plerumque superantibus; foliis oppositis vel alternis elliptico-oblongis subdistanter serratis coriaceis 3-nerviis et valde praesertim in facie inferiore reticulato-venosis utrinque breviter pubescentibus basin versus integris abrupte angustatis breviter sed distincte petiolatis 2.5–5.5 cm. longis 1–2 cm. latis apice acutiusculis vel rotundatis, superioribus gradatim reductis; inflorescentia variabili nunc gracillima spiciformi vel racemiformi nunc laxe corymboso-paniculata; capitulis erectis ca. 11 mm. altis 7 mm. diametro ca. 21-floris plerumque graciliter pedicellatis rarius sessilibus; involucri subcampanulato-cylindrici squamis ca. 6-striatis plerumque acutis ciliatis dorso plus minusve pilosulis saepe purpurascentibus, extimis ovato-oblongis mucronatis; receptaculo glabro; corollis limbum versus atropurpureis; achaeniis sericeis; pappi setis ca. 40. (FIG. 28.)

Eupatorium oliganthes Less. Linnaea, v. 137, t. 2, f. 13 (1830).
Bulbostylis oliganthes (Less.) DC. Prod. v. 139 (1836).
Coleosanthus oliganthus [Less.] Ktze. Rev. Gen. i. 328 (1891).
C. polyanthemus Greene, Pittonia, iv. 126 (1900), forma uberior.

MEXICO: VERA CRUZ: in collibus apricis prope Hacienda de la Laguna, *Schiede & Deppe*, n. 293; ad Mirador, *Sartorius* (hb. Gray.), *Liebmann*, n. 349 (hb. Gray.); collibus siccis, Orizaba, *Mohr & Botteri*, n. 1113a (hb. U. S.); ad Zacuapan, *Purpus*, n. 1858 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). GUERRERO: inter Tixtlam et Chilpancingo, alt. 1830–2135 m., *E. W. Nelson*, n. 2175 (hb. U. S.). JALISCO: ad Rio Blanco, *Palmer* (anno 1886), n. 59 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.) forma uberior; collibus prope Guadalajaram, *Pringle*, n. 1856 pro parte (hb. Mo.). SAN LUIS POTOSI: ad Rascon, *Purpus*, n. 5252 (hbb. Gray., Univ. Calif.). NUEVO LEON: in Sierra Madre prope Monterey, *Pringle*, n. 11,909 (hb. Gray.). MEXICO BOR.-OCC. sine loco exactiore, *Seemann* (hb. Gray.).

FIG. 28. B. oliganthes.

FIG. 29. B. reticulata.

28. B. RETICULATA (DC.) Gray, Pl. Wright. i. 84 (1852)

Suffrutescens adscendente ramosa dense griseo-puberula vel -tomentella; ramis foliosis ca. 3–7-capitulatis; foliis ut dicitur integerrimis oblongis plerisque oppositis adscendentibus, supremis subalternis, coriaceis subtus prominenter reticulato-venosis; capitulis plerisque pedicellatis aut in axillis solitariis aut subcorymbose ad apices ramorum dispositis ca. 20-floris; involucri squamis pluriseriatim imbricatis, interioribus linearibus acutis, exterioribus gradatim brevioribus acuminatis ca. 7-striatis. — Species mexicana minus cognita (distributione exactiore omnino ignota) a praecedente dubitative distincta. (FIG. 29.)

Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881).
Bulbostylis reticulata DC. Prod. vii. 268 (1838).
Coleosanthus reticulatus (DC.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO: sine loco exactiore, *Haenke* (hb. DC., photographia infeliciter pessima in hb. Gray.).

29. **B. verbenacea** (Greene), comb. nov.

Herbacea erecta scabriuscula; caulibus 4–12 dm. altis foliosis scabrido-puberulis subsimplicibus virgatisque vel superne subfastigiatim ramosissimis; foliis subsessilibus oblongis 3-nerviis leviter a media parte serratis coriaceis fere concoloribus pallide viridibus subtus valde reticulato-venosis 3.5–5 cm. longis 1.5–2.1 cm. latis; capitulis in axillis superioribus subsessilibus vel breviter crassiusculeque pedicellatis; pedicellis saepissime pluri-bracteolatis; capitulis ca. 17 mm. altis 6 mm. diametro ca. 14-floris; involucri squamis ca. 21 lanceolatis pluriseriatim imbricatis attenuatis peracutis 6–7-striatis purpureo-tinctis conspicue ciliatis; corollis 6.5 mm. longis; achaeniis (immaturis) 3.7 mm. longis. (Fig. 30.)

Fig. 30. B. verbenacea.

Coleosanthus verbenaceus Greene, Pittonia, iv. 125 (1900).

MEXICO CENT.: San Luis Potosi: alt. 1830–2440 m., *Parry & Palmer*, n. 355 (hbb. Gray., Mo., Phil., U. S.); in umbrosis prope Tlacala, *Schaffner*, nn. 368 (hbb. Gray., Field Mus., N. Y., U. S., Hafn.), 795 (hbb. Field Mus., U. S., Hafn.). Durango: ad Santiago Papasquiaro, *Palmer* (anno 1896), n. 60 (hb. U. S.). Jalisco: in collibus prope Guadalajaram, *Pringle*, n. 1856 pro parte (hbb. Gray., J. D. Sm., Univ. Calif., Phil., U. S.). Morelos: ad Cuernavacam, *Lemmon et ux.* (hb. Gray.) specimen immaturum et dubium capitulis numerosis densiuscule thyrsoideis.

Fig. 31. B. Pringlei.

30. B. Pringlei Gray, Proc. Am. Acad. xvii. 206 (1882)

Herbacea vel paullo lignescens griseo-puberula; ramis foliosis plus minusve flexuosis; foliis oppositis lanceolato-oblongis acutis serratis vel subintegris fere concoloribus supra et in margine scaberrimis subtus molliter crispeque griseo-puberulis prominenter reticulato-venosis 3.5–6 cm. longis 1–2 cm. latis brevissime sed distincte petiolatis; capitulis 18 mm. altis 6–7 mm. diametro ca. 19–24-floris brevissime

pedicellatis saepius a bracteis multo superatis; involucri basi turbinati squamis pluriseriatim imbricatis ca. 37 firmiusculis pallide viridibus vel stramineis 5–8-striatis valde convexis sublucidis, extimis obtusis mucronulatis ciliatis; receptaculo alveolato minute hirtello; corollis ut videtur ochroleucis 9.6 mm. longis; achaeniis 3.5 mm. longis fulvido-sericeis basi flavo-callosis; pappi setis ca. 50 laete albis sursum barbellatis 7.2 mm. longis. (FIG. 31.)

Coleosanthus Pringlei (Gray) Ktze. Rev. Gen. i. 328 (1891).

ARIZONA AUST.: in faucibus petrosis montium Santa Catalina, *Pringle* (hbb. Gray., U. S.); in faucibus pinguibus montium Santa Rita, *Pringle* (hbb. Mo., J. D. Sm., Phil.); prope castellum Huachuca, in montibus Huachuca, *Lemmon*, n. 2737 (hbb. Gray., U. S.); in montibus Lowell, *W. F. Parish*, n. 89 (hb. Gray.).

MEXICO BOR.: SONORA: ad Alamos, *Palmer* (anno 1890), n. 286 (hbb. Gray., Univ. Calif., U. S.). TERR. TEPIC: *Palmer* (anno 1892), sine numero (hb. U. S.).

31. B. KELLERMANII Greenman, Field Columb. Mus. Bot. Ser. ii. 265 (1907)

Suffruticosa ad 1 m. alta erecta tomentella; foliis breviter petiolatis oblongo-lanceolatis crenato-dentatis vel integris obtusis vel acutis 3–6 cm. longis 1–2 cm. latis coriaceis supra sparse hirtellis subtus pallidioribus albido-tomentellis valde reticulato-venosis; inflorescentia foliosa subcorymbose paniculata; capitulis 12–14 mm. altis saepissime 12-floris sessilibus vel subsessilibus; involucri squamis pluriseriatim imbricatis paullo pubescentibus ciliatis, exterioribus ovato-oblongis mucronatis, interioribus lanceolato-linearibus acutis; pappi setis argenteo-albis 6 mm. longis; corollis albis vel purpurascentibus. (FIG. 32.)

GUATEMALA: dept. Baha Vera Paz, in Sierra de las Minas alt. 1158 m., *Kellerman*, n 6127 (hb. Field Mus., phot. in hb. Gray.).

SUBSECT. 6. **AMPLEXICAULES,** SUBSECT. NOV.

Capitula mediocra 11–22-flora graciliter pedicellata in paniculam corymbiformem vel gracilem et elongatam et subcylindricam disposita. Folia ovalia vel ovato-oblonga vel rarius lanceolata basi semper (saltem foliorum caulinorum) plus minusve cordata. — Species 4, herbaceae perennes vel suffruticosae, Civ. Foed. aust.-occ. et Mex. cent. et bor.-occ. et Calif. infer.

CLAVIS SPECIERUM

a. Folia coriacea supra lucida prominulenter reticulata cum glandulis sessilibus sparse obsita ..... 32. *B. cuspidata.*
a. Folia membranacea supra obscura pubescentia *b.*
b. Pedicelli patenter pubescentes non glanduliferi *c.*
c. Pedicelli involucro breviores recti. Capitula in ramis elongatis paniculae racemosa. Calif. infer. ..... 33. *B. subsessilis.*
c. Pedicelli plerique involucro multo longiores flexuosi saepissime in axibus secundariis brevissimis quasi fasciculati. Neo-Mex., Ariz., Mex. bor.-occ. ..... 34. *B. betonicaefolia.*
b. Pedicelli conspicue denseque cum glandulis stipitatis obsiti ..... 35. *B. amplexicaulis.*

FIG. 32. B. Kellermanii.

FIG. 33. B. cuspidata.

32. B. CUSPIDATA Gray, Proc. Am. Acad. xxii. 421 (1887)

Suffruticosa ramosa 4–7 dm. alta; caulibus ramisque teretibus gracilibus crispe puberulis; ramis oppositis adscendentibus; foliis oppositis ovalibus crenato-serratis conspicue cuspidatis utrinque reticulatis supra lucidis laete viridibus glandulari-atomiferis subtus paullo pallidioribus obscuris punctatis in venis margineque ciliolatis 1–3 cm. longis 7–20 mm. latis; capitulis laxe corymboso-paniculatis 12.5 mm. altis ca. 11-floris; involucri squamis exterioribus ovatis ciliatis ca. 5-striatis longiuscule cuspidatis; corollis purpureis 6 mm. longis; achaeniis sericeis 3.7 mm. longis; pappi setis ca. 42 subplumosis laete albis. (FIG. 33.)

Coleosanthus cuspidatus (Gray) Greene, Erythea, i. 54 (1893).

MEXICO CENT.: JALISCO: prope Rio Blanco, *Palmer* (anno 1886), n. 652 (hbb. Gray., J. D. Sm., Phil., U. S.); in collibus petrosis prope Guadalajaram, *Pringle*, nn. 1855 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.), 2724 (hb. Univ. Calif.), 11,494 (hbb. Gray., U. S.); in Sierra de Estaban, alt. 1677 m., *Pringle*, n. 9864 (hbb. Gray., Mo., N. Y., U. S.).

33. **B. subsessilis,** spec. nov.

Herbacea erecta vel paullo decumbens griseo-pubescens 6 dm. alta; caule tereti brunneo crispe pubescente superne ramoso; foliis ovato-oblongis subsessilibus alternis vel suboppositis apice rotundatis vel obtusis margine crenato-serratis utrinque pubescentibus 3–4 cm. longis 2.3–3 cm. latis membranaceis paullo supra basin 3(–5)-nervatis; ramis gracilibus patenti-adscendentibus subsimplicibus 6–11 cm. longis apicem versus racemiferis; capitulis ca. 12-floris ca. 1 cm. altis gracilibus racemose paniculatis; pedicellis rectis 5–9 mm. longis griseo-pilosis; involucri squamis ca. 15 lanceolato-linearibus acutis, exterioribus gradatim brevioribus; receptaculo glabro; corollis tubulatis breviter 5-dentatis; styli ramis elongatis clavellatis; pappi setis ca. 40 albis tenuiter capillaribus; achaeniis ignotis. (FIG. 34.)

FIG. 34. B. subsessilis.

CALIFORNIA INFER.: ad San Pedro Martin, 14 Maio, 1893, *T. S. Brandegee* (hb. Univ. Calif., phot. in hb. Gray.).

NOTA. — Specimen typicum e partibus sequentibus solis constat: 1) sarmentis quattuor decumbentibus foliosis 1–2 dm. altis sterilibus; 2) axe principali multo post anthesin et post delapsum flosculorum lecto involucra senilia vacua patentia exhibente. Capitula pauca vieta caute dissecta indicant flosculos valde immaturos cum pappi setis et styli ramis etc. ut supra dicti.

34. B. BETONICAEFOLIA Gray, Pl. Wright. ii. 72 (1853)

Herbacea erecta patenter villosa; caulibus 1–pluribus 4–8 dm. altis saepius simplicibus foliosis; foliis ovato-oblongis obtusis crenato-serratis basi cordatis saepe amplexicaulibus membranaceis utrinque pubescentibus 3–7 cm. longis 1.6–3.2 cm. latis; capitulis erectis graciliter pedicellatis ca. 15 mm. altis ca. 14-floris in paniculam subcylindricam subracemiformem elongatam dispositis; pedicellis patenter

villosis, pilis eglandulosis; involucri squamis exterioribus ovato-lanceolatis acuminatis dorso pubescentibus saepissime viridibus, interioribus lineari-lanceolatis glabriusculis saepius purpureis; corollis purpureis ad 8 mm. longis; achaeniis 3.5 mm. longis sericeis; pappi setis barbellatis albis. — In collibus montuosisque calcareis, Civ. Foed. aust.-occ. et Mex. bor., frequens. (FIG. 35.)

Gray, Syn. Fl. i. pt. 2, 107 (1852).
Brickellia betonicaefolia, var. *humilis* Gray, Pl. Wright. ii. 72 (1853), forma nana.
Coleosanthus betonicifolius [Gray] Ktze. Rev. Gen. i. 328 (1891).
Coleosanthus betonicaefolius (Gray) Ktze. ex Wooton & Standley, Contrib. U. S. Nat. Herb. xix. 652 (1915).

NEO-MEXICO: in collibus prope metalla cupri, *Wright*, n. 1137 (hbb. Gray., Mo., Phil., U. S.); ad Santa Rita del Cobre, *Greene*, n. 393 (hb. Gray.); in montibus Ursinis, *Rusby*, n. 241 (hbb. Gray., Mo., J. D. Sm., U. S.); in declivitate calcarea ad Kingston, alt. 2058 m., *Metcalfe*, n. 1376 (hbb. Gray., Mo., N. Y., U. S., Jns.); in montibus El Capitan, alt. 2135 m., *Earle*, n. 490 (hbb. Mo., N. Y., U. S.).

ARIZONA: in parte australi, *Lemmon*, nn. 313 (hbb. Gray., U. S.), 327 (hb. Gray.); ad Metcalf, *Davidson* (hb. U. S.); prope castellum Huachuca, *Wilcox*, n. 434 (hb. U. S.); ad metalla Chiricahua, alt. 1982 m., *Blumer*, n. 1795 (hbb. Gray., Mo., N. Y., U. S.); prope Paradise, *Eggleston*, n. 10,893 (hb. U. S.); prope Portal, *Eggleston*, n. 10,950 (hb. U. S.); ad Pine, *Toumey*, n. 669 (hbb. Gray., U. S.).

MEXICO BOR.-OCC.: CHIHUAHUA: in collibus ad pedem montium Sierra Madre, *Pringle*, nn. 1267 (hbb. Gray., J. D. Sm., Phil., U. S.), 1621 (hbb. Mo., Univ. Calif.); in parte civitatis aust.occ., *Palmer* (anno 1885), nn. 434 (hbb. Gray., J. D. Sm., Phil., U. S.), 435 (hbb. Gray., J. D. Sm., U. S.); prope coloniam Garcia, alt. 2200 m., *Townsend & Barber*, n. 348 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.); in montibus Sierra Madre, *Jones* (hb. Jns.). SONORA: in collibus ab Santa Cruz ad orientem vergentibus, *Wright*, n. 1138 (hbb. Gray., Mo., U. S.); inter Bubo et Santa Cruz, *Thurber*, n. 1004 (hb. Gray.).

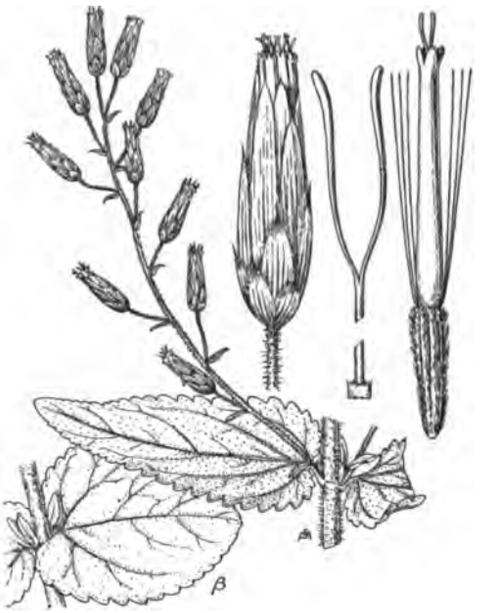

FIG. 35. B. betonicaefolia.

Var. α. **typica,** foliis ovato-oblongis; inflorescentia laxiuscula. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. ELLIPTICA Robinson, foliis late ellipticis 3–4 cm. longis 2–3 cm. latis; panicula densiore subspiciformi. — Proc. Am. Acad. xliii. 37 (1907). (FIG. 35 β.)

MEXICO CENT.: DURANGO: infra Sandiam, alt. 2135 m., *Pringle*, n. 10,102 (hbb. Gray., Mo., Univ., Calif., N. Y., Phil., U. S.).

35. B. AMPLEXICAULIS Robinson, Proc. Am. Acad. xlvii. 199 (1911)

Herbacea glanduloso-pubescens 1–2 m. alta; caulibus foliosis basim versus saepius simplicibus superne ramosis; ramis adscendentibus; foliis oppositis oblongis crenato-serratis arcte sessilibus cordatis amplexicaulibus apice plus minusve angustatis vix acutis 6–13 cm. longis 3–6 cm. latis supra cum pilis inaequilongis moniliformibus obsitis subtus paullo pallidioribus copiose praesertim in venis pubescentibus a puncto multo supra basim 3-nerviis; panicula gracili subcylindrica vel saepe ramosiore et pyramidali; capitulis 12.5 mm. altis 13–22-floris; involucri squamis ca. 20, exterioribus brevibus glandulari-ciliatis et dorso pubescentibus ovato-lanceolatis, interioribus multo longioribus oblongo-linearibus acutis glabriusculis; corollis purpureis ca. 8 mm. longis; achaeniis 3.5 mm. longis; pappi setis 40–60 laete albis barbellatis. — Ariz. aust. et Mex. bor.-occ. praecipue in montuosis calcareis. (FIG. 36.)

FIG. 36. B. amplexicaulis.

Brickellia Wislizeni var. Gray, Pl. Wright. ii. 71 (1853).
B. Wislizeni, var. *paniculata* Gray ex Pringleo, Pl. Mex. anno 1885, nomen nudum.

ARIZONA: in montibus Santa Rita, *Engelmann* (hb. Mo.); in silva foederali Chiricahua, Cochise com, *Eggleston*, n. 10,684 (hb. U. S.); ad Bowie, *Jones* (hbb. U. S., Jns.).

MEXICO BOR.-OCC.: CHIHUAHUA: collibus calcareis prope urbem ita nominatam, *Pringle*, nn. 609 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S.), 945 (hbb. Mo., Univ. Calif.); Sierra en Media, *E. W. Nelson*, nn. 6475 (hbb. Gray., U. S.), 6491 (hbb. Gray., U. S.); prope Batopilas, *Goldman*, n. 204 (hbb. Gray., N. Y., U. S.). SONORA: prope Santa Cruz, *Wright*, n. 1136 (hbb. Gray., Phil., U. S.); ad Huehuerachi, alt. 1220 m., *Hartman*, n. 325 (hb. Gray.); ad angustias Oakridge nominatas, alt. 1750 m., *Hartman*, n. 333 (hbb. Gray., U. S.); prope Alamos, *Rose, Standley & Russell*, n. 12,798 (hb. N. Y.). SINALOA: in Cerro Colorado prope Culiacan, *Brandegee* (hbb. Gray., Univ. Calif., U. S.). CIV. IGNOT.: in Cerro de Pinal, *Seemann* (hb. Gray.).

Var. α. **typica**, foliis ovato-oblongis.—Synon. et distrib. et exsicc. ut supra dictae.

Var. β. LANCEOLATA (Gray) Robinson, foliis angustioribus anguste lanceolatis ca. 6 cm. longis 12–15 mm. solum latis vix amplexicaulibus. — Proc. Am. Acad. xlvii. 199 (1911). (FIG. 36 β.)

Brickellia Wislizeni, var. *lanceolata* Gray, Syn. Fl. i. pt. 2, 107 (1884).

ARIZONA: in montibus San Francisco dictis prope Clifton, *Greene* (hb. Gray.), sub numero 459 (hb. Jns.); ad Metcalf, *Davidson*, n. 286 (hb. U. S.).

SUBSECT. 7. BRACHIATAE, SUBSECT. NOV.

Capitula parva vel mediocra (10–17-flora) graciliter pedicellata laxe paniculata vel ad apices ramorum corymbosa vel etiam in cymulas laxas disposita. Folia graciliter petiolata opposita triangulari-ovata et subhastatim dentata vel rarius lanceolato-oblonga et hastata tenuia vel rare crassiuscula utrinque viridia. — Herbae perennes vel saepius fruticosae arizonicae vel pleraeque mexicanae. Species 6.

CLAVIS SPECIERUM

a. Folia lanceolato-oblonga apice rotundata. Calif. infer. ..... 36. *B. hastata.*
a. Folia deltoideo-ovata saepissime acute acuminata *b*.
  b. Involucri squamae exteriores caudato-appendiculatae. (In hoc loco fortasse quaereri potest ..... 83. *B. grandiflora.*)
  b. Involucri squamae exteriores ovato-lanceolatae acutae *c*.
    c. Folia caulina 1.5–2.5 cm. longa. Petioli 8–(rare)15 mm. longi. Pedicelli glandulari-puberuli vel crispe et eglandulare puberuli, glandulis (ubi adsunt) subsessilibus vel brevissime stipitatis ..... 37. *B. Coulteri.*
    c. Folia caulina 6–7 cm. longa. Petioli 12–33 mm. longi. Pedicelli glandulari-villosi ..... 38. *B. megalodonta.*
  b. Involucri squamae exteriores ovato-oblongae vel suborbiculares apice rotundatae *d*.
    d. Involucri squamae (ca. 32) margine conspicuiter scariosae apice mucronulatae. Bracteolae lanceolatae *e*.
      e. Griseo-pubescens. Folia ad 4 cm. longa membranacea apice acute acuminata post exsiccationem pallide viridia. Mex. ..... 39. *B. brachiata.*
      e. Glaberrima. Folia 1–2.5 cm. longa crassiuscula apice saepissime obtusa vel rotundata post exsiccationem nigrescentia. Calif. infer. ..... 40. *B. glabrata.*
    d. Involucri squamae (ca. 17) margine vix scariosae apice non mucronulatae. Bracteae lineari-filiformes ..... 41. *B. cymulifera.*

36. B. HASTATA Benth. Bot. Sulph. 21 (1844)

Fruticosa; caulibus ramisque minute griseo-tomentellis; foliis oppositis tenuibus graciliter petiolatis oblongo-lanceolatis basi hastato-lobatis aliter integerrimis 3.5–10 cm. longis basi 1–6 cm. latis supra planis glabriusculis subtus obscure tomentellis leviter reticulatis vix pallidioribus glandulari-punctatis; corymbis ramos terminantibus convexis 7–15-capitulatis; capitulis 8–11 mm. longis 12–13-floris;

involucri squamis longitudine valde inaequalibus angustis substramineis 3–4-striatis obtusiusculis; corollis 7.5 mm. longis sursum paullo dilatatis; dentibus limbi ovato-deltoideis extus glandulari-granulatis; styli ramis clavellatis longe exsertis. (FIG. 37.)

FIG. 37. B. hastata.

Bulbostylis ? hastata (Benth.) Walp. Rep. iv. 279 (1848) in indice.
Coleosanthus hastatus (Benth.) Ktze. Rev. Gen. i. 328 (1891).

CALIFORNIA INFER.: ad sinum Magdalena, *Hinds, Barclay;* in insula Santa Margarita, *Brandegee* (hbb. Gray., Univ. Calif., Phil., U. S.).

37. B. COULTERI Gray, Pl. Wright. i. 86 (1852)

Frutescens oppositiramea 3–9 dm. alta glandulari-puberula vel crispe (et non glandulare) puberula; caulibus ramisque patenter adscendentibus flavido-griseis; foliis oppositis deltoideis vel rhombeo-ovatis acutis vel acuminatis graciliter petiolatis utroque hastatim 1–3-dentatis rarissime subintegris utrinque crispe sparseque puberulis vel pulverulentis; capitulis erectis laxe cymoso-paniculatis graciliter pedicellatis ca. 17-floris; involucri squamis ca. 21 anguste lanceolatis vel linearibus acutis vel acuminatis ca. 4-striatis, exterioribus apice saepius laxiusculis, extimis brevibus dorso puberulis; corollis ut videtur flavido- vel viridi-albis saepius purpureo-tinctis 8.2 mm. longis; achaeniis 3.5 mm. longis flavido-brunneis vel -griseis sursum villosulis. — Fruticulus arizonico-mexicanus in montuosis et locis aridulis communis. (FIG. 38.)

FIG. 38. B. Coulteri.

Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881); Wats. Proc. Am. Acad. xviii. 101 (1883); Gray, Syn. Fl. i. pt. 2, 105 (1884).
Coleosanthus Coulteri (Gray) Ktze. Rev. Gen. i. 328 (1891).

ARIZONA: ad Wickenburg, *Palmer* (anno 1876), n. 610 (hbb. Gray., Univ. Calif., U. S.); in montibus Mohawk, *Lemmon*, n. 72 (hb. Gray.); in valliculis pinguibus montium Santa Rita, *Pringle* (hbb. Gray., U. S.); in reservatione silvestre foederali Santa Rita, *Griffiths*, n. 5938 (hbb. Mo., U. S.); milia passuum 8 ab Vail ad aust. spect., alt. 1220 m., *Jones* (hb. Jns.); prope Tucson, *Greene*, n. 1098 (hb. Gray.), *Parish frat.*, sine numero (hb. Univ. Calif.), *W. F. Parish*, n. 88 (hbb. Gray., Mo., J. D. Sm., U. S.), *Beard* (hb. Mo.), *Thornber*, nn. 361 (hb. U. S.), 464 (hbb. Univ. Calif., U. S.), *Griffiths*, n. 2435 (hb. N. Y.), *Rose, Standley & Russell* (hb. U. S.); in montibus Santa Catalina, *Lemmon*, n. 193 (hb. Gray.), *Jones* (hb. Jns.), *Pringle* (hbb. Mo., J. D. Sm., Phil.), *Toumey* (hb. N. Y.), *Griffiths*, n. 2345 (hb. N. Y.); in faucibus giganteis Grand Cañon dictis, *Gray* (hb. Gray.); secundum flumen Salt anglice nominatum, *Smart*, n. 271 (hb. U. S.); in montibus Bradshaw, *Purpus*, n. 8503 (hbb. Mo., Univ. Calif.); ad Congress Junction, *Jones* (hbb. Gray., U. S.); ad Yuma, *G. R. Vasey* (hb. U. S.); ad Bowie, *Jones* (hb. Jns.).

MEXICO: SONORA: ad Durasmillas, *Brandegee* (hb. Univ. Calif.); inter San Pedro et Fronteras, *Hartman*, n. 908 (hb. Gray.); ad Hermosillo, *Maltby*, n. 260 (hb. U. S.), *Rose, Standley & Russell*, n. 12,345 (hbb. N. Y., U. S.); ad Guaymas, *Palmer* (anno 1887), n. 62 (hbb. Gray., J. D. Sm., Univ. Calif., U. S.), *Rose*, n. 1289 (hbb. Gray., U. S.); prope Alamos, *Rose, Standley & Russell*, n. 13,054 (hbb. N. Y., U. S.); Sierra do Los Alamos, *Palmer* (anno 1890), n. 812 (hbb. Gray., J. D. Sm., U. S.) forma uberior viridior foliis majoribus pluridentatis speciei sequenti approximans tamen ob pubescentia potius ad *B. Coulteri* referenda; sine loco exactiore, *Palmer* (anno 1869), n. 19 (hbb. Gray., Phil., U. S.). SINALOA: ad Confradiam prope Culiacan, *Brandegee* (hb. Univ. Calif.) etiam forma uberior; ad Imalam, *Palmer* (anno 1891), n. 1727 (hb. U. S.), *Brandegee* (hb. Univ. Calif.); prope Fuertes, *Rose, Standley & Russell*, n. 13,558 (hbb. N. Y., U. S.). CHIHUAHUA: collibus petrosis prope urbem ita nominatam, *Pringle*, n. 96 (hbb. Gray., U. S.); ad Candelariam, *Stearns*, n. 247 (hb. U. S.). COAHUILA: prope Saltillo, *Palmer* (anno 1898), n. 279 (hbb. Gray., Mo., N. Y., U. S.), *Pringle*, n. 13,536 (hbb. Gray., U. S.); ab Parras ad occ.-aust. spect., *Palmer* (anno 1880), n. 451 (hbb. Gray., J. D. Sm., Phil., U. S.); ad Parras, *Purpus*, n. 1014 (hbb. Univ. Calif., N. Y.); Cerro de Zapatero, *Purpus*, n. 4461 (hbb. Mo., Univ. Calif., U. S.). CIV. IGNOT.: inter San Luis Potosi et San Antonio (texensem), *Parry* (vel in hbb. variis *Parry & Palmer*), n. 358 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.); sine loco exactiore, *Gregg*, n. 479 (hb. Gray.). DURANGO: ad Torreon, *Purpus* (hb. Univ. Calif.); in Cerro de San Ignacio, *Purpus*, n. 4567 (hbb. Gray., Mo., Univ. Calif., U. S.). AGUAS CALIENTES: *Pringle*, nn. 3504 (hb. Gray.), 3932 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.). PUEBLA: inter Petlatcingo et Acatlan, alt. 1250–1360 m., *E. W. Nelson*, n. 2002 (hb. U. S.). COLIMA: ad Manzanillo, *Palmer* (anno 1890), n. 947 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). CALIFORNIA INFER.: ad San Gregorio, *Brandegee* (hb. Univ. Calif.); ad San Felipe, *Purpus*, n. 441 (hbb. Mo., Univ. Calif., U. S.); ad San José del Cabo, *Brandegee*, n. 281 (hb. Univ. Calif.), *Rose*, n. 16,449 (hbb. N. Y., U. S.); ad San Bartolome, *Brandegee* (hb. Univ. Calif.); ad promontorium San Lucas, *Rose*, n. 16,343 (hb. N. Y.).

NOTA 1. — Specimen typicum hujus speciei a Th. Coultero (n. 293, hb. Kew., fragm. et icon simplex a stilo delin. in hb. Gray.) quamquam in California e schedula lectum tamen potius ex Arizona verisimiliter ortum est.

NOTA 2. — Species formas minime valentes duas exhibet: 1) Forma *a.* **typica,** ramulis pedicellisque tenuiter glandulari-puberulis; pilis plerisque patentibus rectiusculis apice capitatis cum vel absque nonnullis crispis non glandularibus intermixtis. (FIG. 38 a.) 2) Forma *b.* **eglandulescens,** forma nova, ramulis pedicellisque crispe griseo-puberulis; pilis vel omnibus vel plerisque eglandularibus. (FIG. 38 b.)

38. B. MEGALODONTA Greenman, Proc. Am. Acad. xl. 34 (1904)

Praecedenti similis sed pubescens; pilis albis tenuibus praesertim a venis foliorum conspicuiter patentibus; foliis multo majoribus 6–7 cm. longis caudato-acuminatis saepius apice falcatis utroque 3–7-dentatis neque carnosulis nec post exsiccationem nigrescentibus; pedicellis filiformibus breviter denseque glandulari-villosis; capitulis ut apud praecedentem. (FIG. 39.)

FIG. 39. B. megalodonta.

MEXICO CENT.: JALISCO: ad Guadalajaram, *Holway*, n. 5022 (hb. Gray.).

39. B. BRACHIATA Gray, Proc. Am. Acad. xxi. 385 (1886)

Patenter ramosa griseo-pubescens vel (var. β) glandulari-puberula; caulibus teretibus foliosis; foliis oppositis graciliter petiolatis deltoideo-ovatis subcordatis acutis utroque ca. 4-dentatis concoloribus utrinque pallide viridibus pubescentibus 3.5–4.5 cm. longis 2.5–3.2 cm. latis membranaceis neque carnosulis nec post exsiccationem nigrescentibus, petiolo 1–1.3 cm. longo tomentoso; panicula dichotome vel trichotome ramosa; pedicellis divergentibus 1.5–2.5 cm. longis; capitulis 15 mm. altis 5 mm. diametro ca. 16-floris; involucri squamis ca. 32 oblongis ca. 5-striatis subglabris apice rotundatis mucronulatis; corollis viridi-albidis 7 mm. longis; achaeniis 3.5 mm. longis flavido-griseis subsericeis; pappi setis laete albis simplicibus. (FIG. 40.)

MEXICO OCC.: CHIHUAHUA: in parte aust.-occ., *Palmer* (anno 1885), n. 169 (hbb. Gray., J. D. Sm., Phil., U. S.).

FIG. 40. B. brachiata.

Var. α. **typica,** ramulis pedicellisque laxe piloso-sublanatis; pilis tenuibus curvatis vel rectiusculis plus minusve interplexis plerisque eglandularibus. — Distrib. et exsicc. ut supra dictae.

Var. β. **adenopoda,** var. nov., ramulis pedicellisque dense et breviter glanduloso-puberulis; pilis rectis patentibus brevissimis glandulari-capitatis; aliter var. *typicae* simillima. (FIG. 40 β.)

MEXICO OCC.: SINALOA: prope oppidum San Blas in dumetis, *Rose, Standley & Russell,* n. 13,374 (hb. U. S., fragm. et phot. in hb. Gray.). Frutex humilis.

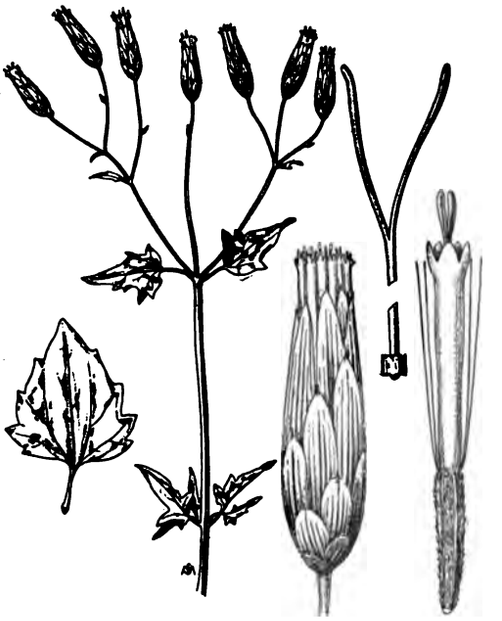

FIG. 41. B. glabrata.

40. **B. glabrata** (Rose), comb. nov.

Fruticosa oppositiramea glaberrima: caulibus ramisque teretibus flavido-griseis sublucidis; foliis deltoideo-ovatis vel rhombeo-oblongis utroque 2–4-dentatis apice obtusiusculis vel etiam rotundatis utrinque glaberrimis carnosulis post exsiccationem paullo nigrescentibus 1–2.5 cm. longis, petiolo ca. 5 mm. longo; capitulis ut apud praecedentem; pappi setis paullo fulvescentibus. (FIG. 41.)

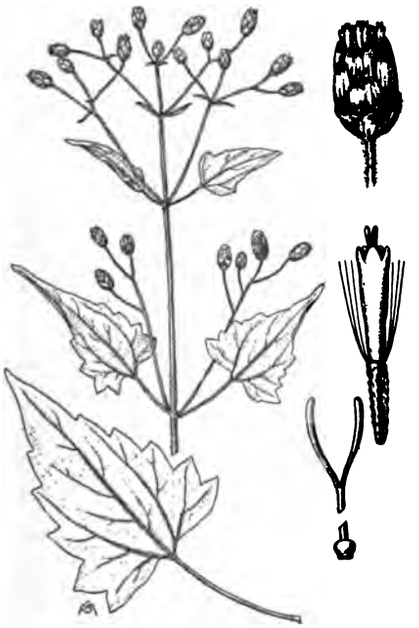

FIG. 42. B. cymulifera.

Brickellia brachiata Vasey & Rose, Contrib. U. S. Nat. Herb. i. 83 (1890), non Grayi.
B. brachiata, var. *glabrata* Rose, ibid. 132 (1892).

CALIFORNIA INFER.: ad San Gregorio, *Brandegee* (hb. Univ. Calif.); ad Santa Rosalia communis, *Palmer* (anno 1890), n. 269 (hbb. Gray., Univ. Calif., U. S.); in rupibus valliculae praeruptae San Pablo, *Purpus,* n. 52 pro parte (hb. Univ. Calif.); insula Carmen, in lateribus vallicularum praeruptarum, *Palmer* (anno 1890), n. 849 (hbb. Gray., U. S.).

NOTA. — Species (an halophytica ?) a praecedente non solum glabritate sed etiam textura et figura et magnitudine minore foliorum distincta. A pecore appetenter depasta (fide Rosei).

41. B. CYMULIFERA Robinson, Proc. Am. Acad. li. 538 (1916)

Subherbacea 3–4 dm. alta; caulibus gracilibus teretibus foliosis crispe puberulis; foliis oppositis graciliter petiolatis hastato-deltoideis caudato-acuminatis grosse dentatis basi late cordatis utrinque laete viridibus sparse crispeque puberulis 3–5.4 cm. longis 2.5–3.8 cm. latis, petiolo 1–4 cm. longo; capitulis ca. 12-floris in cymas oppositas axillares gracillimas laxe patentes 3–5-capitulatas dispositis; involucri squamis ca. 17 convexis viridibus vel atropurpureis margine tenuibus ciliatis apice rotundatis non mucronatis achaeniis pubescentibus. — Species a speciminibus vix maturis solis cognita. (FIG. 42.)

MEXICO CENT.: SAN LUIS POTOSI: ad Minas de San Rafael, *Purpus*, n. 4802 (hbb. Gray., Mo., Univ. Calif.).

SUBSECT. 8. BACCHARIDEAE, SUBSECT. NOV.

Capitula parva vel mediocra 8–26-flora (flosculis apud *B. veronicaefoliam* saepe pluribus) rarius terminalia et subsolitaria saepius in axillis subcongesta secundum ramos paniculae quasi spicato-racemosa. Folia ovata vel rhombea vel suborbiculari-reniformia saepius parva (5–20 mm. longa) rarius majora (ad 60 mm. longa) alterna vel opposita. — Species 8, plus minusve xerophyticae Am. Bor. occ. et Mex. incolentes.

CLAVIS SPECIERUM

a. Involucri squamae intimae 5–9 mm. longae, exteriores non glanduliferae *b.*
  b. Involucri squamae extimae caudato-acuminatae. Capitula pleraque terminalia in ramulis solitaria ca. 26-flora ..... 42. *B. glutinosa.*
  b. Involucri squamae obtusae vel acutae non caudatae *c.*
    c. Folia rhombea grosse dentata, dentibus saepius acutiusculis patentibus *d.*
      d. Capitula 16–17-flora. Folia crassa firme coriacea utrinque reticulata ..... 43. *B. baccharidea.*
      d. Capitula ca. 9-flora. Folia (parva) membranacea vix firmiuscula non reticulata ..... 44. *B. laciniata.*
    c. Folia ovata vel suborbicularia vel reniformia crenato-serrata *e.*
      e. Capitula 8–18-flora 3–5 mm. diametro. Involucri squamae ca. 20–25 *f.*
        f. Capitula minima (9 mm. alta) 8-12-flora. Involucri squamae acutiusculae. Achaenia 2.3 mm. longa ..... 45. *B. desertorum.*
        f. Capitula paullo majora (ca 14 mm. alta) saepius ca. 15(8–18)-flora. Involucri squamae saepissime apice rotundatae rarius acutiusculae. Achaenia 3 mm. longa ..... 46. *B. californica.*
      e. Capitula ca. 28-flora ca. 6 mm. diametro. Involucri squamae exteriores acutae glanduloso-puberulae. Folia late ovata obtusissima crenato-dentata. Calif. infer. (In hoc loco quaereri potest ..... 78. *B. Brandegei.*)
      e. Capitula saepissime ca. 25(18–62)-flora 6–11 mm. diametro. Involucri squamae 37–51. Folia suborbicularia vel reniformia parva (8–14 mm. longa) ..... 47. *B. veronicaefolia.*
a. Involucri squamae intimae 12–14 mm. longae, exteriores sub lente conspicuiter cum glandulis stipitatis praecipue in margine obsitae ..... 48. *B. Palmeri.*

42 B. GLUTINOSA Gray, Proc. Am. Acad. xxi. 385 (1886)

Fruticosa intricate ramosissima glanduloso-puberula novellis vernicosa; caulibus nigris geniculatis, ramulis hinc inde spiniforme induratis pungentibus; foliis (plerisque oppositis) minimis flabellari-rhomboideis 5–8 mm. longis laciniato-dentatis utrinque viridibus subtiliter glanduloso-puberulis non reticulatis; capitulis ca. 16 mm. altis 5 mm. diametro ca. 26-floris; involucri squamis ca. 43 substramineis, exterioribus gradatim minoribus, extimis caudato-acuminatis 2–3-striatulis; receptaculo glabro; achaeniis atrobrunneis gracillimis 4 mm. longis in costis obscure sparseque hispidulis aliter glabris. — Species bene distincta semel lecta ut videtur hucusque nunquam reperta. (FIG. 43.)

MEXICO BOR.: COAHUILA: in oris rupium calcarearum montium ad Jimulco, *Pringle*, n. 143 (hbb. Gray., Mo., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.).

FIG. 43. B. glutinosa.

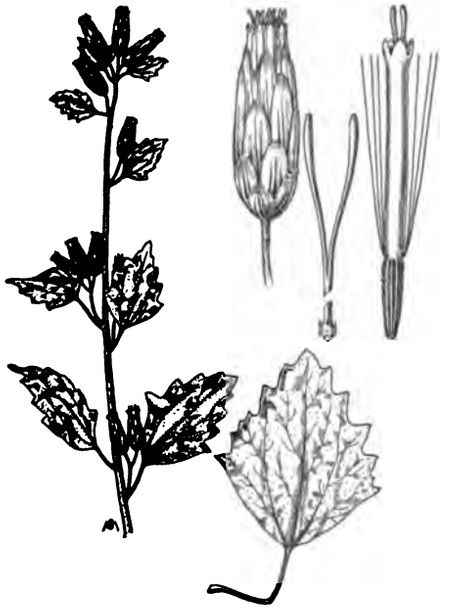

FIG. 44. B. baccharidea.

43. B. BACCHARIDEA Gray Pl. Wright. i. 87 (1852)

Fruticosa erecta superne ramosa; caulibus leviter flexuosis pallide griseo-brunneis, cortice exfoliante; ramis adscendentibus foliosis; ramulis tenuissime puberulis; foliis plerisque alternis rhombeo-ovatis coriaceis grosse laciniato-dentatis basi integerrimis cuneatis utrinque viridibus valde reticulatis subglabris sed saepe vernicosis 1–3.8 cm. longis; capitulis 16–17-floris brevissime pedicellatis bracteas vix superantibus vel quam eae brevioribus; involucri squamis brunnescenti-stramineis 3–4-striatis anguste oblongis obtusis subglabris; achaeniis 2–2.3 mm. longis pallidis sursum villosulis; pappi setis ca. 20 albis vix scabridis. (FIG. 44.)

Gray, Bot. Mex. Bound. 75 (1859), & Syn. Fl. i. pt. 2, 106 (1884).
Coleosanthus baccharideus (Gray) Ktze. Rev. Gen. i. 328 (1891).

TEXAS OCC.: in montibus ab El Paso ad orientem spect., *Wright*, n. 252 (hbb. Gray., Mo., Phil., U. S.); in eodem loco, *Gray* (anno 1885), hb. Gray.

NEO-MEXICO: ad Cobre, *Bigelow* fide Grayi; in valle Gila, *Greene* (hb. Jns.).

ARIZONA: in montibus San Francisco nominatis prope Clifton, *Greene*, n. 445 (hb. Gray.), sine numero (hb. Mo.); collibus calcareis circum Portal, Cochise com., *Eggleston*, n. 10,975 (hb. U. S.); in silva reservata foederali Santa Rita, *Griffiths*, n. 5942 (hb. Mo.); prope Tucson, *Griffiths*, n. 2133 (hb. N. Y.); ad locum Warsaw Mill anglice dictum, *Mearns*, n. 2682 (hb. U. S.).

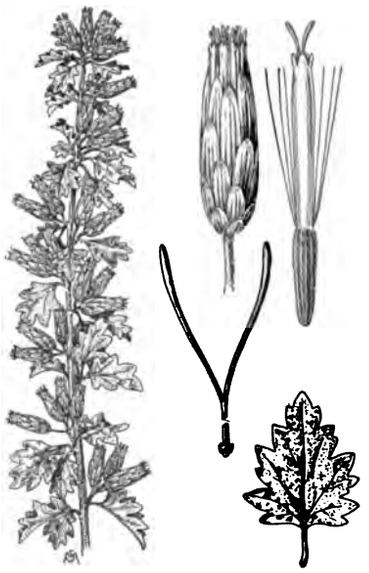

FIG. 45. B. laciniata.

44. B. LACINIATA Gray, Pl. Wright. i. 87 (1852)

Fruticosa 6–12 dm. alta; caulibus pallide griseis a cortice fibroso tectis superne subfastigiatim ramosis; ramis teretibus niveo-puberulis foliosis; panicula elongato-pyramidali; capitulis subracemosis 12 mm. altis 2.8 mm. diametro ca. 9-floris; pedicellis 1–3 mm. longis; involucri squamis ca. 13 viridi-stramineis 4-striatis anguste oblongis obtusiusculis; corollis 5.7 mm. longis viridi- vel flavido-albis limbum versus purpureo-tinctis; achaeniis pallide griseis sursum villosulis 2.8 mm. longis; pappi setis capillaribus vix barbellatis. — Am. Bor. aust.-occ. et Mex. bor. (FIG. 45.)

Gray in Torr. Bot. Mex. Bound. 74 (1859), & Syn. Fl. i. pt. 2, 106 (1884).
Brickellia dentata Sch. Bip. in Seem. Bot. Herald, 301 (1856), quoad pl. Seem. non quoad syn. nominifer.; Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881) quoad pl. cit.
Coleosanthus laciniatus (Gray) Ktze. Rev. Gen. i. 328 (1891).

TEXAS OCC.: in montibus ab El Paso ad orient spect., *Wright*, n. 253 (hbb. Gray., Mo., Phil., U. S.); El Paso, *Mulford*, n. 255 (hb. Mo.); in montibus Guadelupe, *Havard*, n. 1301 (hb. Mo.); in montibus Chisos, *Nealley*, n. 434 (hb. U. S.); secundum rivulum Limpia, *Andrews*, n. 81 (hbb. Gray., Arn. Arb.).

NEO-MEXICO: in mesa ab montibus Organ ad occ. spect., Dona Ana com., *Wooton* (hbb. Univ. Calif., U. S., Jns.), *Wooton & Standley* (hbb. N. Y., U. S.).

MEXICO: sine loco exactiore, *Gregg*, n. 336 (hb. Gray.); inter San Luis Potosi et Tampico, *Palmer* (1878–9), n. 1078 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.). NUEVO LEON: prope Monterey, *Berlandier*, n. 1783 (hb. Gray.). COAHUILA: prope Saltillo, *Berlandier*, n. 106 (hbb. Gray., Phil.), *Palmer* (anno 1880), n. 450 (hbb. Gray., J. D. Sm., Phil., U. S.), *Palmer* (anno 1898), n. 320 (hbb. Gray., Mo., N. Y., U. S.), *Pringle*, n. 13,034 (hbb. Gray., U. S.); Sierra de Parras, *Purpus*, n. 4714 (hbb. Gray., Mo., Univ. Calif., U. S.). CHIHUAHUA: ad Bachimbam, *Thurber*, n. 831 (hb. Gray.); in planitiebus Santa Eulalia, *Wilkinson* (hbb. J. D. Sm., U. S.); ad coloniam Diaz,

E. W. Nelson, n. 6438 (hbb. Gray., U. S.); secundum rivulos inter colles petrosos prope urbem Chihuahuam, *Pringle*, nn. 628 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.), 971 (hbb. Mo., Univ. Calif.). ZACATECAS: in locis depressis ad Cedros, *Lloyd*, nn. 9 (hbb. Mo., U. S.), 34 (hb. Gray.).

FIG. 46. B. desertorum.

45. B. DESERTORUM Coville, Proc. Biol. Soc. Wash. vii. 68 (1892)

Fruticosa 1 m. alta intricate ramosa; caulibus pallide griseis a cortice fibroso tectis; ramis ramulisque niveis tenuissime puberulis gracilibus flexuosis paullo induratis vix pungentibus; foliis oppositis vel alternis ovatis crenato-serratis obtusis 3–9 mm. longis et latis utrinque griseo-tomentellis, petiolo 1–2.5 mm. longo; capitulis in axillis superioribus glomeratis parvis 9 mm. altis 2.5 mm. diametro 8–12-floris subsessilibus; involucri squamis ca. 21 viridi- vel brunnescenti-stramineis 3–4-striatis acutiusculis dorso paullulo tomentellis; corollis albidis 4.6 mm. longis; achaeniis 2.3 mm. longis sursum• villosulis; pappi setis ca. 14 subaequalibus tenuiter capillaribus albis laeviusculis. — Frutex valde xerophyticus, *B. californicam* aliquid simulans tamen ut videtur ab ea distincta. (FIG. 46.)

Coleosanthus desertorum Coville, Contrib. U. S. Nat. Herb. iv. 119 (1893).
Brickellia californica, var. *desertorum* (Coville) Parish ex Hallio, Univ. Calif. Publ. Bot. iii. 33 (1907).

CALIFORNIA AUST.: in desertis Colorado nominatis inter Banning et Seven Palms, *Orcutt* (hb. U. S., fragm. in hb. Gray.); in parte aust.-occ. desertorum eorundem ad Dos Cabesas, *Orcutt* n. 1464 (hbb. Gray., Mo., Univ. Calif., U. S.); San Bernardino com. ad fontem Lone Willow, *Coville*, n. 164 (f. Covillei l. c.); in vallicula praerupta Blue dicta ad fontes Palm, *Eastwood*, n. 3065 (hb. Arn. Arb.); prope Riverside, *G. R. Hall* (hb. Univ. Calif.), *Zumbro*, n. 362 (hb. Univ. Calif.); in declivitatibus montanis ad angustias San Gorgonio secundum flumen White Water anglice dictum, *Engelmann* (hb. Mo., phot. in hb. Gray.); in latere orientali vallis Panamint, alt. 428 m., *Jones*, n. 12,039 (hb. Jns.).

NEVADA AUST.: ad locum Good Springs dictum, *Jones*, n. 11,997 (hb. Jns.).

ARIZONA BOR.: ad fontem milia passuum 8 supra trajectum Pierce's dictum, *Jones*, n. 5077 l (hbb. U. S., Jns.), multo post anthesin qua de causa paullo dubia.

NOTA. — Sarmenta ut videtur hujus speciei tenuia foliosa exhibent folia primaria deltoideo-ovata duplice dentato-lobulata paullo tenuiora ad 2.5 cm. longa et lata. Ea sunt verisimiliter axes

post pluvias copiosas celeriter evoluti. In apicibus reperiuntur capitula pauca omnino huic speciei congrua. Vide, e. g., specimen a cl. G. Engelmannio ad angustias San Gorgonio secundum flumen White anglice dictum 11 Nov. 1880 lectum et nunc in hb. Mo. Bot. Gard. sub n. 52,019 servatum.

46. B. CALIFORNICA (Torr. & Gray) Gray, Pl. Fendl. 64 (1849)

Fruticosa 6–10 dm. alta; caulibus teretibus crispe puberulis primo albidis maturitate purpureis vel brunnescentibus vel saepissime griseis; ramis adscendentibus foliosis; foliis plerisque alternis petiolatis deltoideo-ovatis utrinque crispe puberulis concoloribus dentatis vel crenato-serratis plerisque obtusis basi subtruncatis vel saepe late cordatis a basi 3-nerviis 1–5 cm. longis et latis; petiolo 4–20 mm. longo; capitulis numerosis minimis in axillis solitariis vel saepius cymoso-aggregatis et secundum ramos quasi spicatis breviter sed gracile pedicellatis 14 mm. altis 3 mm. diametro ca. 15(8–18)-floris; receptaculo glabro; involucri squamis anguste oblongis subacutis vel saepius apice rotundatis 3–6-striatis viridi-stramineis vel purpureo-tinctis, exterioribus gradatim brevioribus, extimis ovalibus; corollis ca. 7.6 mm. longis flavido-albidis nonnunquam purpureo-tinctis; achaeniis ca. 3 mm. longis; pappi setis albis vel plus minusve sordide purpureo-brunnescentibus paullo scabridis. — Species per Am. Bor. occ. late distributa et variabilis. (FIGG. 47, 48.)

FIG. 47. B. californica.

Gray, Pl. Wright. i. 85 (1852), & Bot. Calif. i. 300 (1876), & Syn. Fl. i. pt. 2, 106 (1884); Wats. Bot. King Rep. 138 (1871); Hall, Univ. Calif. Publ. Bot. iii. 32 (1907).
Bulbostylis Cavanillesii DC. Prod. v. 138 (1836), quoad pl. Dougl.
Bulbostylis californica Torr. & Gray, Fl. ii. 79 (1841).
Brickellia Wrightii Gray, Pl. Wright. ii. 72 (1853), & Bot. Mex. Bound. 75 (1859).
Coleosanthus californicus (Torr. & Gray) Ktze. Rev. Gen. i. 328 (1891) cum varietatibus *normali* et *Wrightii;* Jepson, Fl. W. Mid. Calif. 571 (1901).
C. Wrightii (Gray) Britton, Trans. N. Y. Acad. Sci. xiv. 43 (1894).
C. albicaulis Rydb. Bull. Torr. Bot. Club, xxxi. 646 1905).
C. melissaefolius Greene, Leafl. i. 150 (1905).
Brickellia albicaulis (Rydb.) Nelson, Man. Bot. Rky. Mts. 487 (1909).

COLORADO: *Brandegee*, n. 844 (hbb. Mo., Univ. Calif.), sine numero (hb. Gray.); *Clements*, n 63 (hb. N. Y.); *Clements & ux.*, n. 78 (hbb. Gray., Mo., N. Y., U. S.); *Crandall*, n. 2785 (hbb. N. Y., U. S.); *Eastwood* (hbb. Mo., N. Y.); *Engelmann* (hb. Mo.); *Greene* (hb. Gray.); *Jones*, n. 770 (hbb. Gray., U. S., Arn. Arb., Jns.); *Letterman* (hbb. Mo., N. Y.); *Osterhout*, nn. 2411

(hb. N. Y.), 3155 (hb. Gray.), 4608 (hb. N. Y.); *Patterson* (hb. Gray.); *Rose & Fitch*, n. 17,514 (hbb. Mo., N. Y., U. S.); *Rydberg* (hb. N. Y.); *Wislizenus*, n. 1049 (hb. Mo.).

UTAH: *Garrett* (hbb. Gray., Phil.); *Jones*, nn. 1921 (hbb. J. D. Sm., U. S., Arn. Arb., Jns.) forma foliis majusculis, 5663y (hb. Jns.), 5986 (hbb. Mo., Univ. Calif., N. Y., Jns.); *Purpus*, n. 7031 (hbb. Mo., Univ. Calif.); *Rydberg & Garrett*, n. 10,004 (hb. N. Y.); *Shear*, nn. 3261 (hbb. N. Y., U. S.), 4589 (hb. N. Y.); *Tracy & Evans*, n. 709 (hb. N. Y.); *Watson*, n. 495 (hb. Gray.).

IDAHO: ad locum "City of Rocks" anglice nominatum f. Watsoni.

NEVADA: *Chestnut & Drew* (hb. U. S.); *Watson*, n. 495 (hbb. Gray., U. S.).

CALIFORNIA: *Abrams*, n. 4173 (hbb. Mo., N. Y.); *Adams*, n. 20 (hb. Univ. Calif.); *Babcock* (hb. Univ. Calif.); *Baker*, nn. 3696 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.), 4568 (hbb. Gray., Mo., N. Y.); *Blochman* (hb. Univ. Calif.); *Bolander*, n. 2625 (hbb. Gray., U. S.); *K. Brandegee* (hb. Univ. Calif.); *T. S. Brandegee* (hb. Univ. Calif.); *Braunton*, nn. 730 (hbb. Univ. Calif., U. S.), 1183 (hbb. Mo., Univ. Calif., N. Y., U. S.); *Bridges*, n. 245 (hbb. Gray., N. Y., U. S.); *Chestnut*, nn. 399 (hb. U. S.), 525 (hb. U. S.), sine numero (hb. Univ. Calif.); *Cleveland* (hb. Gray.); *Congdon* (hb. U. S.); *Emi e Cuming*, n. 114 (hb. Gray.); *Davy*, n. 2716 (hb. Univ. Calif.); *Douglas* (hb. Gray.); *Eastwood*, nn. 213 (hb. U. S.), 224 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Arn. Arb.); *Eggleston*, nn. 10,895 (hb. U. S.), 10,913 (hb. U. S.); *Elmer*, n. 4189 (hb. U. S.); *Engelmann* (hb. Mo.); *Greene*, n. 375 (hb. Gray.); *Grinnell*, n. 382 (hb. Univ. Calif.); *Hansen*, n. 1380 (hbb. Mo., U. S., Arn. Arb.); *Hartweg*, n. 1768 (hbb. Gray., N. Y.); *Hasse* (hb. Mo.); *Heermann* (hb. Gray.); *Hooker & Gray* (hb. Gray.); *Jepson* (hb. U. S.); *Kellogg & Harford*, n. 361 (hbb. Gray., Mo., N. Y., U. S., Brown Univ.); *King* (hb. Univ. Calif.); *Kuntze*, n. 32B (hb. N. Y.); *Leiberg*, n. 5385 (hb. U. S.); *McClatchie* (hb. N. Y.); *Mearns*, n. 3846 (hb. N. Y.); *Michener & Bioletti* (hb. U. S.); *Orcutt*, n. 112 (hb. U. S.), sine numero (hbb. J. D. Sm., Univ. Calif.); *Palmer* (anno 1875), nn. 125 (hbb. Univ. Calif., Phil.), 171 (hb. U. S.), sine numero (hbb. Gray., Jns.); *Parish frat.*, n. 566 (hbb. Gray., Mo., J. D. Sm., U. S.); *Phillips & Sargent* (hb. Gray.); *Purpus*, n. 1253 (hb. Univ. Calif.); *Sargent* (hb. Arn. Arb.); *Torrey*, n. 200 (hb. N. Y.); *Toumey*, n. 3 (hb. Univ. Calif.); *J. P. Tracy*, n. 4674 (hb. Univ. Calif.); *Trask* (hbb. Mo., U. S.); *Ward*, n. 123 (hb. U. S.), sine numero (hb. Gray.); *Wilkes Exped.*, n. 1614 (hb. U. S.); *W. G. Wright*, n. 7 (hb. Gray.); *Zumbro*, n. 420 (hb. Univ. Calif.).

ARIZONA: *Blumer*, nn. 1766 pro parte (hb. Mo.), 3620 (hbb. Gray., Univ. Calif.); *Coues & Palmer*, n. 387 (hbb. Gray., Mo.); *Eggleston*, nn. 10,658 (hb. U. S.), 10,665 (hb. U. S.), 10,740 (hb. U. S.); *Goldman*, n. 2227 (hb. U. S.); *Goodding*, n. 908 (hbb. Gray., N. Y.); *Griffiths*, nn. 3456 (hbb. N. Y., U. S.), 5996 (hbb. Mo., U. S.), 6003 (hbb. Mo., U. S.), 6084 (hbb. Mo., U. S.); *Griffiths & Thornber*, nn. 64 (hb. U. S.), 147 (hb. U. S.); *Jones*, nn. 4326 (hbb. N. Y., U. S., Arn. Arb., Jns.), 5095p ? (hb. U. S.), 6066e (hb. Jns.), 6066f (hb. Jns.), etiam sine numero e locis nonnullis; *Lemmon*, n. 315 (hb. Gray.); *Lowell* (hb. Arn. Arb.); *Mearns*, nn. 180 (hb. N. Y.), 1011 (hbb. Gray., N. Y., U. S.); *Pilsbry* (hb. Phil.); *Pringle* (hbb. Gray., Mo., J. D. Sm., N. Y., Phil.); *Rehder*, n. 48 (hb. Arn. Arb.); *Rusby* (hb. N. Y.); *Sargent* (hb. Arn. Arb.); *Sheldon* (hb. Mo.); *Thornber*, n. 115 (hbb. Mo., Univ. Calif., N. Y., U. S., Jns.); *Toumey* (hb. Univ. Calif.); *M. Zuck*, n. 50 (hb. U. S.), sine numero (hb. U. S.).

NEO-MEXICO: *Bigelow* (hbb. Gray., N. Y.); *Blumer*, n. 66 (hbb. Gray., N. Y., U. S.); *Diehl*, n. 701 (hb. Jns.); *Ellis*, n. 325 (hbb. Mo., U. S.); *Fendler*, nn. 308 (hbb. Gray., Mo.), 346 (hbb. Gray., Mo.); *Goldman*, nn. 1498 (hb. U. S.), 1711 (hb. U. S.); *Greene* (hbb. Mo., Univ. Calif., Jns.); *Jones* (hbb. J. D. Sm., Jns.); *Metcalfe*, n. 635 (hbb. Mo., N. Y., U. S.); *Mulford*, n. 822 (hbb. Mo., N. Y.); *Rehder*, n. 273 (hb. Arn. Arb.); *Rose & Fitch*, n. 17,593 (hbb. N. Y., U. S.); *Rusby*, n. 238 (hbb. Mo., J. D. Sm., Univ. Calif.) forma foliis magnis; *Sanders* (hb. Phil.); *Skehan*, n. 77 (hbb. Gray., Mo., N. Y., U. S.); *Standley*, n. 7517 (hb. U. S.), sine numero (hb. Mo.); *Wooton*,

n. 488 (hbb. Mo., N. Y., U. S.), sine numero (hbb. Mo., Univ. Calif., U. S., Jns.); *Wooton & Standley* (hbb. N. Y., U. S.); *Wright*, n. 1139 (hbb. Gray., Mo., Phil., U. S.).

TEXAS OCC.: in regione Llano Estacado hispanice dicta, *Bigelow* (hbb. Gray., Mo.); in montibus Guadelupe, *Havard* (hb. Mo.).

MEXICO BOR.-OCC.: CHIHUAHUA: in collibus petrosis prope urbem ita nominatam, *Pringle*, nn. 605 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.) forma in var. *lobulatam* transiens, 924 (hbb. Mo., Univ. Calif.); in Sierra en Media, *E. W. Nelson*, n. 6477 (hbb. Gray., U. S.). SONORA: ad Santa Cruz, *Thurber*, n. 931 (hb. Gray.).

CALIFORNIA INFER.: ad Hansen's Ranch, *Orcutt*, n. 1250A (hb. Mo.); in valle Jamul, *Schoenfeldt*, n. 3846 (hb. U. S.).

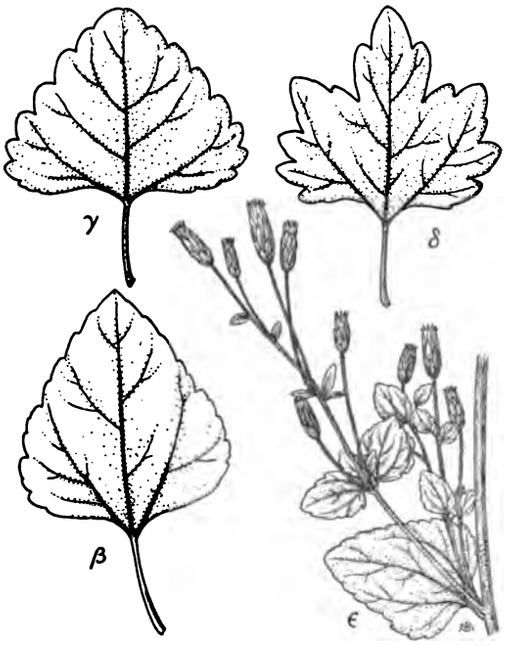

FIG. 48. B. californica,
var. β. tenera. var. δ. lobulata.
" γ. reniformis. " ε. Jepsonii.

Var. α. **normalis** (Ktze.), comb. nov., foliis deltoideo-ovatis dentatis vel crenato-serratis textura firmiuscula. — Distrib. et synon. et exsicc. ut supra dictae. (FIG. 47.)

Var. β. **tenera** (Gray), comb. nov., foliis tenuibus plerisque majoribus 3.5–4.5 cm. longis ovatis basi abrupte angustatis vel rotundatis; capitulis plerisque in axillis glomeratis. — Varietas minoris momenti difficiliter delimitatu. (FIG. 48 β.)

Brickellia tenera Gray, Pl. Wright. ii. 72 (1853).
B. Wrightii, var. *tenera* Gray, Syn. Fl. i. pt. 2, 106 (1884).
Coleosanthus tener (Gray) Ktze. Rev. Gen. i. 328 (1891).
C. axillaris Greene, Leafl. i. 149 (1905).

UTAH: in vallicula praerupta Big Cottonwood nominata, *Clemens* (hb. Jns.).

NEO-MEXICO: in Sierra com., in declivitate petrosa prope Hillsboro, alt. 1650 m., *Metcalfe*, n. 1446 (hbb. Gray., Mo., N. Y., U. S., Jns.); ad locum anglice "City of Rocks" nominatum, *Mulford*, n. 1142 (hb. Mo.).

ARIZONA: in montibus Santa Catalina, alt. 1830 m., *Lemmon*, n. 60 (hb. Gray.).

NEVADA: Panaca, *Jones* (hbb. Jns., Gray.).

MEXICO BOR.-OCC.: SONORA: in vallicula montana prope Santa Cruz, *Wright*, n. 1140 (hbb. Gray., Phil., U. S.).

Var. γ. **reniformis** (Gray), comb. nov., foliis tenuibus majusculis reniformi-ovatis latioribus quam longis grosse crenatis. (FIG. 48 γ.)

Brickellia reniformis Gray, Pl. Wright. i. 86 (1852).
B. Wrightii, var. *reniformis* Gray, Syn. Fl. i. pt. 2, 106 (1884)
Coleosanthus reniformis (Gray) Rydb. Bull. Torr. Bot. Club, xxxi. 646 (1905).

TEXAS OCC.: in valle ab El Paso 56 km. in orient. spect., *Wright*, n. 251 (hbb. Gray., Mo.); Puerto del Paysano, *Bigelow*, n. 7 (hb. Gray.).

Var. δ. **lobulata,** var. nov., foliis tenuibus, caulinis majusculis (ad 4 cm. longis et latis) deltoideo-ovatis late cordatis grosse crenato-lobulatis, lobulis ad 7 mm. longis; foliis rameis ut apud var. *normalem.* (FIG. 48 δ.)

MEXICO BOR.-OCC.: CHIHUAHUA: in collibus prope Parral, alt. 1768 m., *Pringle*, n. 13,543 (spec. typ. in hbb. Gray., U. S.).

Var. ε ? **Jepsonii,** var. nov., foliis et pubescentia ut apud var. *typicam;* capitulis longe pedicellatis; pedicellis 1–5 cm. longitudine; involucri squamis exterioribus acutiusculis, interioribus acutis. (FIG. 48 ε.)

CALIFORNIA: Solano com., secundum rivulum Alamo, 2 Sept. 1891, *W. L. Jepson*, sine numero (hbb. J. D. Sm., Univ. Calif., phot. in hb. Gray.).

NOTA. — Planta valde dubia ut videtur anomala seu fortasse teratologica. Nihilo minus occurrent praecipue in California boreali ut mihi benigne indicavit cl. H. M. Hall formae nonnullae intermediae pedicellis plus minusve elongatis et involucri squamis aliquid acutatis quae hanc varietatem cum var. *normali* paullum connectere videntur, e. g. exemplara sequentia: secundum rivulum prope Yreka, *G. D. Butler*, n. 948 (hb. Univ. Calif.); prope Hydesville, *J. P. Tracy*, n. 960 (hb. Univ. Calif.); ad locum Bartlett's dictum, Lake com., *K. Brandegee* (hb. Univ. Calif.); ad Oak Run, Shasta com., *M. S. Baker*, n. 282 (hb. Univ. Calif.); in ripis siccis, Blue Lakes, *H. M. Hall*, n. 9590 (hbb. Gray., Univ. Calif.); vallicula praerupta Weldon dicta in montibus Vaca, *Jepson* (hb. Univ. Calif.).

47. B. VERONICAEFOLIA (HBK.) Gray, Pl. Wright. i. 85 (1852)

Fruticosa ramosissima 6–9 dm. alta minute griseo-puberula quasi pulverulenta vel breviter hispidula, pilis aut (var. α) omnibus (sub lente) brevissimis non moniliformibus prorsus vergentibus aliquando cum glandulis capitatis paucis interspersis aut (var. β) nonnullis longioribus rectiusculis moniliformibus patentibus; foliis oppositis suborbiculari-ovatis vel reniformibus crenatis obtusis vel apice rotundatis basi rotundatis vel saepius cordatis utrinque puberulis subtus reticulatis 4–16 mm. longis 7–25 mm. latis, petiolo 3–6 mm. longo; capitulis saepissime ramulos breves terminantibus 18–25-floris 16 mm. altis 6 mm. diametro; involucri turbinato-campanulati vel -cylindrici squamis 35–40 apice rotundatis 3–6-striatis, interioribus oblongis, exterioribus gradatim brevioribus ciliatis, extimis suborbiculari-ovatis apicem versus et media in parte griseo-tomentellis; corollis albis vel roseis ca. 6 mm. longis; achaeniis 3–4 mm. longis griseo-brunneis in costis sursum hispidulis; pappi setis ca. 35 aequalibus albis barbellatis. — Species mexicana communis et aliquid variabilis sed omnibus ab aliis facile distinguenda. (FIGG. 49, 50.)

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881).
Eupatorium veronicaefolium HBK. Nov. Gen. et Spec. iv. 112, t. 341 (1820).
Bulbostylis veronicaefolia (HBK.) DC. Prod. v. 139 (1836).
Eupatorium glechomaefolium Moc. ex. DC. l. c. in synon.
Brickellia Galeottii Gray, Pl. Wright. i. 85 (1852).
Coleosanthus veronicifolius [HBK.] Ktze. Rev. Gen. i. 328 (1891).
Coleosanthus Galeottii (Gray) Ktze. l. c. (1891).

MEXICO: sine loco exactiore, *Ehrenberg*, n. 494 (hb. U. S.), *Schiede* (hb. U. S.), *Gregg*, nn. 89, 353, 440, 613 (omnes in hb. Gray.), *Berlandier*, n. 3162 (hb. Phil.). COAHUILA: *Berlandier*, nn. 115 (hb. Gray.), 1374 (hb. Gray.); *Palmer* (anno 1898), n. 291 (hbb. Gray., Mo., U. S.), 583 (hbb. Gray., Mo., N. Y., U. S.), 585 (hbb. Mo., N. Y.); *Purpus*, n. 4650 (hbb. Gray., Mo., Univ. Calif., U. S.). DURANGO: *Palmer* (anno 1898), n. 586 (hbb. Gray., U. S.). ZACATECAS: *Lloyd & Kirkwood*, nn. 15 (hbb. Mo., U. S.); 49 (hb. Gray.). SAN LUIS POTOSI: *Purpus*, n. 4825 (hbb. Gray., Mo., Univ. Calif., U. S.). QUERETARO: *Berlandier*, nn. 1288 (hbb. Gray., N. Y. ubi cum var. γ commixta), 1293 (hb. Gray.). MEXICO et TERR. FOED.: *Humboldt & Bonpland; Berlandier*, n. 1250 (hbb. Gray., Mo.); *Pringle*, n. 9867 (hbb. Gray., Mo., N. Y.); *Bourgeau*, n. 1088 (hbb. Gray., U. S.); *Schaffner*, n. 31 (hb. Gray.); *C. & E. Seler*, n. 1324 (hb. N. Y.). PUEBLA: *Liebmann*, n. 342 (hb. Gray.); inter Tehuacán et Esperanza, *J. N. & J. S. Rose*, n. 11,438 (hbb. N. Y., U. S.); *Purpus*, n. 5612 (hb. Univ. Calif.). VERA CRUZ: Orizaba, *F. Mueller*, n. 299 (hbb. Gray., N. Y.). OAXACA: *Galeotti*, n. 2104 (hb. Kew., fragm. in hb. Gray.); *E. W. Nelson*, nn. 1546 (hbb. Gray., U. S.), 1926 (hbb. Gray., U. S.); *Pringle*, n. 5944 (hb. Mo.); *L. C. Smith*, n. 925 (hb. Gray.); *C. L. Smith*, n. 382 (hbb. Mo., N. Y., U. S.); *Conzatti & González*, n. 1264 (hb. Gray.); *C. & E. Seler*, n. 1370 (hbb. Gray., J. D. Sm., N. Y.); *Holway*, n. 3686 (hb. Gray.).

FIG. 49. B. veronicaefolia.

Var. α. **typica,** minute griseo-puberula quasi pulverulenta, pilis brevissimis (etiam sub lente) non moniliformibus prorsus vergentibus albidis, glandulis paucis majoribus purpureis passim interspersis; foliis viridibus plus minusve utrinque puberulis. — Synon. et distrib. et exsicc. ut supra dictae. (FIG. 49.)

Var. β. **senilis,** var. nov., foliis paullo minoribus dense griseo-tomentellis.

MEXICO: PUEBLA: in collibus supra Chalchicomulam, alt. 2745 m., *Pringle*, n. 8563 (spec. typ. in hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.); ad Atzitzintlam, *Purpus*, n. 2793 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

Var. γ. **petrophila** (Robinson), comb. nov., habitu foliis inflorescentia var. *typicae* simillima differt notabiliter pubescentia, pilis septatis quasi moniliformibus

brevibus patentibus attenuatis cum glandulis numerosis capitatis brevissimis interspersis; capitulis plurifloris, flosculis saepius 25–35. (FIG. 50.)

Brickellia veronicaefolia, var. β Gray, Pl. Wright. i. 85 (1852).
B. petrophila Robinson, Proc. Am. Acad. xxxvi. 486 (1901).

MEXICO CENT.–BOR.: sine loco exactiore, *Berlandier*, nn. 1267 (hb. Gray.), 1307 (hbb. Gray., N. Y., Phil. ubi cum var. *typica* commixta). SONORA: *Schott*, n. (Comp.) 24 (hb. Field Mus.). CHIHUAHUA: collibus petrosis prope urbem ita nominatam, *Pringle*, nn. 610 (hbb. Gray., Univ. Calif., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.), 946 (hb. Mo.); in planitiebus Santa Eulalia, collibus *Wilkinson* (hbb. J. D. Sm., N. Y., U. S.); circum Parral, alt. 1770 m., *Pringle*, n. 13,541 (hbb. Gray., U. S.). DURANGO: in planitiebus et collibus prope urbem ita nominatam, *Palmer* (anno 1896), n. 753 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). ZACATECAS: locis saxosis, alt. 2135–2449 m., *Purpus*, nn. 501 (hbb. Mo., Univ. Calif., U. S.), 503 (hbb. Mo., Univ. Calif., U. S.); alt. 2440 m., *Deam*, n. 140 (hb. Gray.); *Diquet* (hb. N. Y.); *Jones*, n. 287 (hb. Jns.). SAN LUIS POTOSI: in arenosis, *Schaffner*, nn. 366 (hbb. Gray., N. Y., U.S., Hafn.), 793 (hbb. N. Y., U.S., Hafn.); prope urbem San Luis Potosi, alt. 1830–2449 m., *Parry & Palmer*, n. 351 (hbb. Gray., Mo., Phil., U. S.); sine loco exactiore, *Orcutt*, n. 5435 (hb. Mo.). GUANAJUATO: *Dugès*, n. 449 (hb. Gray.). PUEBLA: in calcareis ad Tehuacan, *Purpus*, n. 484 (hbb. Mo., Univ. Calif. U. S.).

FIG. 50. B. veronicaefolia, var. petrophila.

NOTA. — Haec planta quamquam fere semper ob indumento facile cognoscibilis, tamen nonnunquam certe in var. *typicam* intergraditur qua de causa melius in loco varietatis quam pro speciem distinctam tractanda est.

Var. δ. **umbratilis** (Robinson), comb. nov., capitulis paullo majoribus saepius 40–62-floris plerisque ramulos longioribus saepe subnudos pedunculiformes terminantibus; inflorescentia propterea laxiuscula; indumento inter varr. α et γ aliquid intermedia.

Brickellia petrophila, var. *umbratilis* Robinson, Proc. Am. Acad. xxxvi. 487 (1901).

MEXICO CENT.: COAHUILA: in vallicula umbrosa ad Parras, *Palmer* (anno 1898), n. 438 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., U. S.). DURANGO: ad Mapimi, *Palmer* (anno 1898), n. 521 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

48. B. PALMERI Gray, Proc. Am. Acad. xv. 30 (1879)

Subherbacea erecta glandulari-puberula scabrida; caule tereti pluricostato purpureo-brunneo sordide tomentello; ramis adscendentibus foliosis; foliis subal-

ternis ovatis serratis vix acutis basi rotundatis coriaceis utrinque viridibus et cum glandulis sessilibus obsitis subtus paullo pallidioribus reticulato-venosis 18–30 mm. longis 12–30 mm. latis quam internodia plerumque multo brevioribus; capitulis 18 mm. altis 7.5 mm. diametro ca. 19-floris graciliter pedicellatis sublaxe paniculatis suberectis; involucri squamis ca. 24 acutis vel acuminatis valde inaequalibus ca. 7-striatis, exterioribus glanduloso-puberulis; receptaculo minute hirtello; corollis ut videtur viridi-albis vel ochroleucis 11 mm. longis; achaeniis atrobrunneis hirsutulis 3.2 mm. longis. — Species mexicana bene distincta. (FIG. 51.)

FIG. 51. B. Palmeri.

Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881).
Coleosanthus Palmeri (Gray) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT.: SAN LUIS POTOSI: *Parry & Palmer*, n. 354 (hbb. Gray., Mo., Phil., U. S.); in umbrosis prope San Miguelito, *Schaffner*, nn. 367 (hbb. Gray., N. Y., U. S.), 794 (hbb. N. Y., U. S.).

Var. α. **typica,** foliis cum glandulis solis subsessilibus utrinque obsitis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **amphothrix,** var. nov., suffrutescens; foliis utrinque vel saltem in facie inferiore cum glandulis subsessilibus et cum pilis attenuatis griseis omnino eglanduliferis obsitis; foliis saepius (non semper) paullo longioribus et proportione angustioribus. — Varietas ut videtur frequentior et distributione ad occ. magis vergens. (FIG. 51 β.).

MEXICO: ZACATECAS: in collibus, *Pringle*, nn. 1751 (spec. typ. in hbb. Gray., Mo., J. D. Sm., Univ. Calif. Phil., U. S.), 181 (hbb. Gray., Mo., J. D. Sm., N. Y., Phil., U. S., Arn. Arb.); *Jones*, n. 290 (12,043 hb. Jns.). DURANGO: *Palmer* (anno 1896), n. 647 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). AGUAS CALIENTES: *Pringle*, n. 240 (hb. Gray.); *Rose & Painter*, n. 7763 (hb. U. S.). JALISCO: prope Guadalajaram, *Pringle*, n. 13,669 (hb. Gray.). COAHUILA vel NUEVO LEON, *Palmer* (anno 1880), n. 2079 (hb. Gray.).

SUBSECT. 9. **COLEOSANTHUS** (CASS.), SUBSECT. NOV.

Capitula 10–26-flora 11–19 mm. alta pedicellata vel rare (apud *B. glomeratam*) subsessilia. Folia saltem caulina petiolata ovata vel lanceolata vel elliptico-

oblonga (2–)3–15 cm. longa. — Herbae perennes vel fruticosae maxima ex parte mesophyticae, nonnullae pro genere procerae (2–5 m. altae).

Coleosanthus Cass. Bull. Soc. Philom. 1817, p. 67 (1817), & Dict. x. 36 (1818).

Species 25, pleraeque mexicanae et centrali-americanae, nonnullae etiam neo-mexicano-arizonicae. Subsectio omnium difficillima.

CLAVIS SPECIERUM

a. Involucri squamae exteriores gradatim breviores, extimae brevissimae *b.*
b. Involucri squamae extimae obtusae vel acutae sed nunquam filiformi-appendiculatae *c.*
c. Achaenia maturitate 3–3.7 mm. longa *d.*
d. Folia tenuiora caudato-attenuata. Neo-Mex., Ariz., Mex. bor. ..... 49. *B. Rusbyi.*
d. Folia aliquid firmiuscula vel coriacea nunquam caudato-acuminata *e.*
e. Folia elliptico- vel rhombeo-ovata *f.*
f. Capitula pleraque sessilia glomerata ..... 50. *B. glomerata.*
f. Capitula pleraque pedicellata *g.*
g. Inflorescentia conspicue dichotoma. Pappi setae ca. 60 ..... 51. *B. hebecarpa.*
g. Inflorescentia paniculata plus minusve elongata. Pappi setae 40–45 *h.*
h. Folia saepius conduplicata parvula, caulina 3–3.5 cm. longa. 52. *B. conduplicata.*
h. Folia plana majora, caulina 4.5–6 cm. longa ..... 53. *B. Nelsonii.*
e. Folia suborbiculari-ovata saepius cordata crassa tomentosa ..... 54. *B. paniculata.*
e. Folia deltoideo-ovata coriacea vel saltem crassiuscula *i.*
i. Involucri squamae interiores acutae ..... 55. *B. secundiflora*, v. *nepetaefolia.*
i. Squamae interiores obtusae vel obtusiusculae ..... 56. *B. Parryi.*
c. Achaenia maturitate 4–5.5 mm. longa *j.*
j. Involucri squamae intermediae et saepius interiores obtusae nonnunquam mucronatae *k.*
k. Folia crassiuscula vel coriacea *l.*
l. Folia deltoideo-ovata *m.*
m. Involucri squamae extimae ovato-lanceolatae acutiusculae ..... 56. *B. Parryi.*
m. Involucri squamae extimae late ovales, apice rotundatae dorso albo-tomentosae ..... 57. *B. tomentella.*
l. Folia lanceolata ..... 58. *B. lancifolia.*
k. Folia tenuiora membranacea *n.*
n. Folia caulina alterna ovato- vel lanceolato-oblonga supra basin 3(–7)-nervia ..... 59. *B. nutans.*
n. Folia caulina opposita a basi 3-nervia ..... 60. *B. orizabensis.*
j. Involucri squamae intermediae et interiores acutae vel attenuatae *o.*
o. Folia ovato-lanceolata. Pedicelli bene evoluti dense cum glandulis stipitatis obsiti ..... 61. *B. pendula.*
o. Folia rite ovata vix acuta textura chartacea *p.*
p. Capitula secunde racemosa ..... 62. *B. Seemanni.*
p. Capitula thyrsoidea ..... 63. *B. saltillensis.*
o. Folia deltoideo- vel suborbiculari-ovata nunquam chartacea *q.*
q. Folia caulina deltoidea grosse crenata. Involucri squamae extimae caudato-acuminatae. Mex. cent. et bor. ..... 64. *B. odontophylla.*
q. Folia caulina serrata vel leviter crenata vel integriuscula. Involucri squamae extimae acutae vel acuminatae non caudato-acuminatae. Mex. cent. et aust. et Am. Cent. *r.*
r. Caulis ad inflorescentiam molliter lignescens a cortice flavido-griseo tectus. Capitula dense cymoso-glomerata; glomerulis subglobosis. Involucri squamae argenteo-villosae subscariosae. Costa Rica ..... 65. *B. argyrolepis.*

r. Caulis inflorescentiam versus vix vel nullo modo lignescens, cortice saepius brunnescente. Cymae densae vel laxae nunquam subglobosae *s.*
s. Inflorescentia laxa, cymis valde nutantibus vel quasi pendulis. Folia caulina saepius suborbiculari-ovata pleraque cordata. Pedicelli plerumque glandulari-puberuli.....66. *B. squarrosa.*
s. Inflorescentia densiuscula, cymis erectis vel paullo nutantibus. Folia deltoideo-ovata *t.*
t. Folia tenuiora membranacea basi rotundata non cordata *u.*
u. Pedicelli villosi. Capitula 16 mm. alta. Involucri squamae pleraeque virides latiuscule scarioso-marginatae. Guat.....67. *B. guatemalensis.*
u. Pedicelli glandulari-puberuli. Capitula ca. 14 mm. alta. Involucri squamae pleraeque purpurascentes vix angustissime scarioso-marginatae. Mex. aust. regione orizabensi.....68. *B. Botterii.*
t. Folia firmiuscula vel subcoriacea crenato-serrata saepius (saltem pagina inferiore) velutina.....69. *B. adenocarpa.*
b. Involucri squamae extimae filiforme appendiculatae *v.*
v. Involucrum subcylindricum ca. 6 mm. diametro. Pappi setae 35–40. Mex. cent. et bor.....64. *B. odontophylla.*
v. Involucrum campanulatum 8–10 mm. diametro. Pappi setae ca. 20. Civ. Foed. occ. (Hic quaereri potest fortasse.....84. *B. grandiflora.*)
a. Involucri squamae extimae longiusculae subherbaceae vel aliquid foliaceae interioribus vix dimidio breviores vel eas aequantes vel etiam superantes *w.*
w. Folia subtus molliter tomentosa. Mex. aust. et Am. Cent.....70. *B. pacayensis.*
w. Folia vix puberula vel glabriuscula. Neo-Mex. et Ariz. *x.*
x. Pedicelli breves 3–9 mm. longi. Capitula ca. 4 mm. diametro paniculata..71. *B. floribunda.*
x. Pedicelli elongati usque ad 6 cm. longi. Capitula ca. 6 mm. diametro laxe corymbosa.....72. *B. chenopodina.*

49. B. Rusbyi Gray, Syn. Fl. i. pt. 2, 106 (1884)

Herbacea perennis; caulibus 1 vel pluribus erectis 6–10 dm. altis e radice crassa orientibus; foliis plerisque alternis deltoideo- vel rhombeo-ovatis caudato-acuminatis grosse crenato-dentatis graciliter petiolatis tenuibus utrinque viridibus supra glabriusculis subtus paullo pallidioribus griseo-tomentellis vel subglabris 5–10 cm. longis 2–4 cm. latis, petiolo 1.5–2.5 cm. longo; capitulis vel paucis in axillis superioribus cymosis vel (individuorum uberiorum) numerosis et in paniculam pyramidalem foliosissimam dispositis 11 mm. altis 4.3 mm. diametro ca. 16-floris; involucri squamis ca. 24 anguste oblongis apice plerumque rotundatis (interioribus acutiusculis) 3–4-striatis substramineis saepe purpurascentibus. — Civ. Foed. aust.-occ. et Mex. bor. (Fig. 52.)

Coleosanthus Rustyi [Gray] Ktze. Rev. Gen. i. 328 (1891), sphalm.
C. Rusbyi (Gray) Ktze. ex Hellero, Cat. N. A. Pl. 135 (1898).

NEO-MEXICO: prope Brazos Cañon, Rio Ariba com., *Standley & Bollman*, n. 10,955 (hb. U. S.); in montibus El Capitan, Lincoln com., *Earle*, n. 400 (hbb. Mo., N. Y. ubi cum *B. californica*

commixta); in montibus Sacramento, *Rehder*, n. 342 (hb. Arn. Arb.); in montibus Organ nominatis, *G. R. Vasey* (hbb. Gray., U. S.), alt. 1982 m., *Wooton*, n. 451 (hbb. Mo., Univ. Calif., N. Y., U. S., Jns.), sine numero (hb. U. S.); in declivitate calcarea ad Percha aust., Sierra com., alt. 2735 m., *Metcalfe*, n. 1455 (hbb. Gray., Mo., N. Y., U. S., Jns.) forma uberior sub nomine inedito cl. Greenei distributa; prope Fierro, *Diehl*, n. 285 (hb. Jns.); in montibus Pinos Altos, *Greene*, n. 370 (hbb. Gray., Phil.); in montibus Mogollon, *Greene* (hb. Jns.), *Rusby*, n. 241½ (hb. Gray.), *Wooton* (hb. U. S.).

FIG. 52. B. Rusbyi.

ARIZONA AUST.: in valle Rucker, *Lemmon*, n. 317 (hb. Gray.); in declivitatibus petrosis montium Huachuca, *Mearns*, n. 2609 (hb. U. S.), *Jones* (hb. Jns.), *Goodding*, nn. 890 (hbb. Gray., N. Y.), 1347 (hb. N. Y.); in montibus Rincon, alt. 2440 m., *Blumer*, n. 3403 (hbb. Gray., Mo.); prope castellum Huachuca, *Lemmon*, n. 2735 (hbb. Gray., U. S.); in montibus Santa Rita, *Jones* (hb. Jns.), *Griffiths & Thornber*, n. 177 (hbb. N. Y., U. S.); in montibus Santa Catalina, *Griffiths*, nn. 7162 (hb. Mo.), 7174 (hb. Mo.); sine loco exactiore, *Nealley*, n. 200 (hb. U. S.).

MEXICO BOR.: CHIHUAHUA: in rupibus fluminis prope Guerrero, *Pringle*, n. 1268 (hbb. Gray., J. D. Sm., Phil., U. S.); in rupibus siccatis, Sierra Madre, *Pringle*, n. 1622 (hbb. Mo., Univ. Calif.); in faucibus San Diego dictis, *Hartman*, n. 782 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., U. S.); ad coloniam Garcia, alt. 2200 m., *Townsend & Barber*, n. 362 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.). SONORA: ad Huehuerachi, *Lloyd*, n. 422 (hb. Gray.); in montibus San José, *Mearns*, n. 1002 (hb. U. S.).

50. B. GLOMERATA Fernald, Proc. Am. Acad. xxxvi. 504 (1901)

Fruticosa ramosa scabra 1 m. alta; caule et ramis adscendentibus sordide puberulis foliosis; foliis oppositis ovatis vel ovato-oblongis coriaceis crenato-serratis utroque obtusis vel modice acutis supra scaberrimis rugosis subtus vix pallidioribus valde reticulato-venosis breviter griseo-pubescentibus 2–6.5 cm. longis 1.4–4 cm. latis, petiolo 5–15 mm. longo; capitulis subsessilibus plerisque ad ramorum apices in glomerulos 3–5-capitulatos congestis ca. 12 mm. altis 5.2 mm. diametro ca. 11-floris; involucri squamis pluriseriatim imbricatis ca. 6-striatis obtusis (vel intimis solis acutiusculis) conspicue arachnoideo-ciliatis; achaeniis fulvis vel atrobrunneis 3.6 mm. longis. — Species austro-mexicana bene distincta. (FIG. 53.)

MEXICO AUST.: OAXACA: inter Panixtlahuaca et Juquila, alt. 915 m., *E. W. Nelson*, n. 2391 (hbb. Gray., U. S.); prope San Bartala, *Liebmann*, n. 339 (hb. Gray.), *C. & E. Seler*, n. 1655

(hb. Gray.); in silvis quercorum pinorumque supra San Carlos Yautepec, *C. & E. Seler*, n. 1765 (hb. Gray.). MORELOS: prope Cuernavacam, alt. 1460 m., *Pringle*, n. 10,403 (hbb. Gray., U. S.). GUERRERO: prope Acapulco, *Palmer* (1894–5), n. 497 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., U. S.). Prope confinium inter civitates Michoacan et Guerrero, alt. 1200 m., in Sierra Madre, *Langlassé*, n. 760 (hbb. Gray., U. S.) forma cum inflorescentia dichotoma capitulis primordialibus in furcis solitariis longius (ca. 1 cm.) pedicellatis, sed aliter non differens.

FIG. 53. B. glomerata.

51. B. HEBECARPA (DC.) Gray, Pl. Wright. i. 85 (1852)

Suffruticosa dichotome ramosa puberula; caule ramisque griseo-brunneis foliosis; foliis oppositis ovatis apice acutis basi acutis vel rotundatis crenato-serratis coriaceis supra scabris rugulosis subtus vix pallidioribus reticulatis griseo-tomentellis a basi 3-nerviis 2–3 cm. longis 1–2 cm. latis, petiolo 3–6 mm. longo; capitulis subsolitariis; pedicellis 8–15 mm. longis saepe arcuatis vel apice nutantibus dense glandulari-puberulis; involucri squamis ca. 14 laxe imbricatis purpurascentibus ca. 6-striatis dorso hirtellis vix acutis; achaeniis 3.7 mm. longis dense sericeo-villosis; pappi setis ca. 60 albis (paullo flavescentibus) distincte barbellatis. (FIG. 54.)

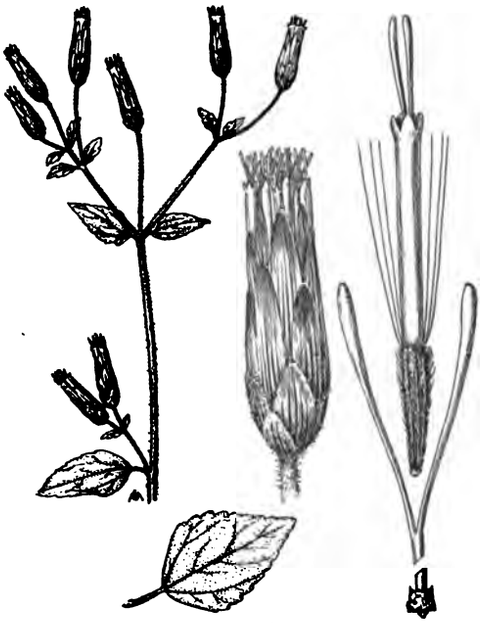

FIG. 54. B. hebecarpa.

Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881).
Bulbostylis hebecarpa DC. Prod. v. 138 (1836).
Bolbostylis hebecarpa (DC.) Hook. & Arn. Bot. Beech. 297 (1840).
Coleosanthus hebecarpus (DC.) Ktze. Rev. Gen. i. 328 (1891).
Brickellia colimae Rose, Contrib. U. S. Nat. Herb. i. 333 (1895).

MEXICO: sine loco exactiore, *Haenke* (hb. DC., phot. in hb. Gray.), *Née* (hb. Gray.). TEPIC: prope Acaponetam, *Rose, Standley & Russell*, n. 14,337 (hb. U. S.). JALISCO: *Beechey* (hb. Kew., fragm. in hb. Gray.). COLIMA: *Palmer* (anno 1891), n. 1160 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., U. S.). MORELOS: prope Puenta de Ixtla, *Rose & Hay*, n. 5319 (hb. U. S.).

52. **B. conduplicata** (Robinson), comb. nov.

Herbacea perennis erecta 6–9 dm. alta; radice lignosa; caulibus pluribus virgatis superne modice ramosis foliosis purpureis crispe griseo-puberulis; foliis suboppositis ovato-oblongis saepissime conduplicatis crenato-serratis utroque angustatis sed vix acutis subcoriaceis utrinque puberulis viridibus supra scabris subtus vix pallidioribus reticulatis, petiolo 6–10 mm. longo; capitulis cymoso-paniculatis saepius erectis ca. 12 mm. altis 5 mm. diametro ca. 12-floris; involucri squamis atropurpureis ca. 7-striatis, interioribus lineari-oblongis vix acutis, exterioribus gradatim brevioribus, extimis ovatis acuminatis dorso hirtellis et margine arachnoideo-ciliatis; achaeniis 3.5 mm. longis hirtellis; pappi setis ca. 43 laete albis sublaevibus. — Species mexicana habitu inter *B. cylindraceam* et *B. betonicaefoliam* circiter intermedia. (FIG. 55.)

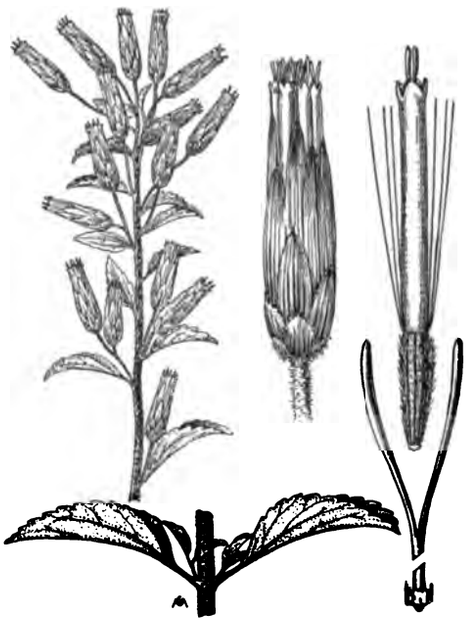

FIG. 55. B. conduplicata.

Brickellia betonicaefolia, var. *conduplicata* Robinson, Proc. Am. Acad. xliii. 37 (1907).

MEXICO BOR.–CENT.: COAHUILA; in montibus prope locum General Cepeda nominatum, alt. 1920 m., *Pringle*, n. 10,081 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.); in Sierra de la Paila, *Purpus*, nn. 4713 (hbb. Univ. Calif., U. S.), 4824 (hb. Univ. Calif.). SAN LUIS POTOSI: in collibus petrosis ad angustias San José, *Pringle*, n. 3171 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.); ad metalla San Rafael in Sierra de Guascana, *Purpus*, n. 5127 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); ad Media Luna prope flumen Verde, *Palmer* (anno 1904), n. 78 (hbb. Gray., N. Y., U. S.).

NOTA. — Specimina in monte Vieja, Tex. occ., ab *Havard* lecta et sub n. 9 (hbb. Gray., U. S.) distributa folia forma hujus speciei sed brevius petiolata ut apud *B. cylindraceam* exhibentia sunt forma dubia minus cognita et ultius scrutanda.

53. **B. Nelsonii**, spec. nov.

Herbacea vel basi paullo lignescens erecta superne ramosa tenuiter griseo-pubescens; caulibus flavido-brunneis; ramis adscendentibus gracilibus; foliis oppositis ovatis subacutis crenato-serratis tenuibus vel vix firmiusculis basi subcuneatis integris 3-nerviis utrinque viridibus scabridis 3–6 cm. longis 1.5–4 cm.

latis, petiolo gracili 8–15 mm. longo; capitulis in paniculam foliosam laxe dispositis plerumque erectis ca. 11 mm. altis 4 mm. diametro ca. 11-floris; pedicellis filiformibus 1–1.4 cm. longis; involucri squamis ca. 16 acutis vel acuminatis substramineis 6–8-striatis; achaeniis atrobrunneis griseo-sericeis 3 mm. longis; pappi setis ca. 40 laete albis vix scabridis. (Fig. 56.)

Fig. 56. B. Nelsonii.

MEXICO: Tamaulipas: in valle Jaumave, alt. ca. 610 m., *E. W. Nelson.* n. 4449 (spec. typ. in hbb. Gray., U. S.); inter San Luis Potosi et Tampico, *Palmer* (1878–9), n. 1087 pro parte (hb. Gray.). Nuevo Leon: in umbrosis secundum flumen San Juan, prope Monterey, *Pringle*, n. 8912 (hbb. Gray., Mo., Field Mus., N. Y., Phil., U. S.).

54. B. paniculata (Mill.) Robinson, Proc. Am. Acad. xlii. 48 (1906)

Fruticosa erecta ramosa griseo-tomentosa 0.8–2 m. alta; foliis oppositis suborbiculari-ovatis crenato-serratis subacuminatis basi rotundatis vel saepius late cordatis crassis supra griseo-tomentellis saepe bullatis scabridis subtus canescenti-tomentosis 2.5–7.5 cm. latis a basi 3-nerviis, petiolo crassiusculo; panicula oppositiramea rigidiuscula folioso-bracteata; internodiis bracteas plerumque superantibus; capitulis plerisque erectis ca. 18-floris 12 mm. altis 6 mm. diametro; pedicellis cum pilis glandulari-capitatis obsitis; involucri squamis ca. 20 laxe imbricatis viridibus sed saepe purpureo-tinctis 5-striatis, interioribus oblongo-linearibus acutiusculis, exterioribus ovato-lanceolatis acutis subsquarrosis ciliatis dorso sparse hirsutis etiam cum glandulis subsessilibus densius obsitis; corollis ca. 7 mm. longis; achaeniis 2.7 mm. longis brunneis sursum griseo-villosis non glanduliferis; pappi setis ca. 50 albis

Fig. 57. B. paniculata.

distincte barbellatis fere plumosis. — Species bene distincta per Mex. aust. et Am. Cent. late distributa et ut videtur frequens. (FIG. 57.)

Eupatorium paniculatum Mill. Dict. ed. 8, n. 15 (1768).
E. Verae Crucis Steud. Nom. ed. 2, i. 609 (1840).
Ageratum paniculatum hort. ex Steud. l. c. (1840).
Eriopappus paniculatus hort. ex Steud. l. c. (1840).
Eupatorium rigidum, Benth. Pl. Hartw. 88 (1841), non Sw.
Brickellia Hartwegi Gray, Pl. Wright. i. 85 (1852); Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881).
Coleosanthus rigidus (Benth.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO AUST.: sine loco exactiore, *Ehrenberg*, n. 711 (hb. U. S.), *Schiede* (hb. U. S.). JALISCO: collibus prope Guadalajaram, *Pringle*, nn. 1792 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.), 9462 (hbb. Gray., U. S.), 9866 (hbb. Gray., Mo., N. Y., U. S.), 13,540 (hbb. Gray., U. S.); inter San Sebastian et Las Palmas, alt. 610–915 m., *E. W. Nelson*, n. 4130 (hbb. Gray., U. S.). TERR. TEPIC: ad oppidum ita nominatum, *Palmer* (anno 1892), sine numero (hb. U. S.). GUERRERO: inter Chilapam et Tixtlam, alt. 1585–2135 m., *E. W. Nelson*, n. 2171 (hb. U. S.). OAXACA: *Pringle*, n. 6268 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.); *Alvarez*, n. 729 (hb. Gray.); *E. W. Nelson*, n. 2411 (hbb. Gray., U. S.); *Conzatti & Gonzdlez*, n. 1089 (hb. Gray.); *C. & E. Seler*, nn. 1371 (hb. N. Y.), 1389 (hb. Gray.), 1766 (hb. Gray.). VERA CRUZ: *Houston* (hb. Brit. Mus., phot. in hb. Gray.); in terris saxosis prope Zacuapan, *Purpus* (anno 1907), n. 1857 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); in terris exsiccatis prope Tantoyucam, *Ervendberg*, n. 310 (hbb. Gray., Phil.). CHIAPAS: ad San Bartolomé, *Goldman*, n. 754 (hb. U. S.).

GUATEMALA: *Hartweg*, n. 598 (hbb. Kew., N. Y., icon stilo del. et fragm. in hb. Gray.); *Kellerman*, n. 4750 (hb. U. S.); *Oersted* (hb. Gray.); *Skinner* (hb. Gray.); prope Neuton, alt. 915–1220 m., *E. W. Nelson*, n. 3529 (hb. Gray.).

NICARAGUA: Masaya, *Baker*, n. 2202 (hbb. Gray., U. S.); Granada, *Lévy*, n. 1334 (hb. Hafn.), *Baker*, n. 2317 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

COSTA RICA: in monte ignivomo El Viejo, *Oersted* fide Hemsl. l. c. (sub nomine *B. Hartwegi*).

55. B. SECUNDIFLORA (Lag.) Gray, Pl. Wright. i. 85 (1852)

Fruticosa 9–12 dm. alta superne ramosa pubescens; foliis alternis firmiusculis deltoideo-ovatis acutis crenato-serratis basi subtruncatis supra viridibus scabridis subtus paullo pallidioribus griseo-tomentellis reticulato-venosis 3-nerviis 3–7 cm. longis 2–5 cm. latis, petiolo 5–25 mm. longo; capitulis numerosis breviter pedicellatis aut in axillis subsolitariis aut in paniculam elongatam thyrsiformem foliosam densiusculam dispositis ca. 20-floris erectis vel nutantibus et secundis; involucri cylindrico-campanulati squamis ca. 23 viridibus vel purpurascentibus 4–6-striatis, intimis lanceolato-linearibus nunc attenuatis nunc acutis, exterioribus gradatim brevioribus, extimis ovatis acuminatis plus minusve dorso hirsutulis; achaeniis 3.6 mm. longis griseo-tomentellis; pappi setis ca. 50 laete albis obscure scabridis. (FIG. 58.)

Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881), quoad pl. Berlandieri.
Eupatorium secundiflorum Lag. Nov. Gen. et Spec. 25 (1816).
Bulbostylis secundiflora (Lag.) DC. Prod. v. 138 (1836) excl. syn. *Eupatorium nutans* HBK.
Bulbostylis scorodoniaefolia Kunth, Ind. Sem. Hort. Berol. 1846, p. 12 (1847).
Brickellia cylindracea Hemsl. l. c. 105 (1881), quoad pl. mex., non Grayi.
Coleosanthus secundiflorus (Lag.) Ktze. Rev. Gen. i. 328 (1891).

FIG. 58. B. secundiflora.

MEXICO: sine loco exactiore, *Bates* (hb. Phil.). TAMAULIPAS: inter Tulam et Tampico, *Berlandier*, n. 757 (hbb. Gray., Phil.); inter San Luis Potosi et Tampico, *Palmer* (1878–9), n. 1087 pro parte (hbb. Gray., Mo., Phil., U. S.). HIDALGO: ad Pachucam, *Holway*, n. 5249 (hb. Gray.); collibus prope Escandon, alt. 2287 m., *Pringle*, n. 13,538 (hbb. Gray., U. S.). CIV. IGNOT.: inter urbem Mexico et Queretaro, *Berlandier*, n. 1247 (hb. Gray.). MEXICO et TERR. FOED.: prope urbem Mexico, *Parry & Palmer*, n. 363½ (hb. Gray.); Chapultepec, *Schaffner*, n. 22 (hb. Gray.); Montezuma prope Guadelupe, *Bourgeau*, n. 1091 (hbb. Gray., U. S.); Tacubaya, *W. Schumann*, n. 59 (hb. Gray.); in agris rhyaliticis supra Tlalpam, alt. 2440 m., *Pringle*, n. 9862 (hbb. Gray., Mo., U. S.). OAXACA: in valle ita nominata, *E. W. Nelson*, n. 1556 (hb. U. S.).

Var. *α*. **typica,** ramulis et pedicellis et saepius involucri squamis exterioribus dense conspicueque cum glandulis stipitatis obsitis cum vel absque pilis non glanduliferis intermixtis. — Synon. et distrib. et exsicc. ut supra dictae. (FIG. 58 *α*.).

Var. *β*. **nepetaefolia** (HBK.), comb. nov., pedicellis et saepius involucri squamis exterioribus hirsutulis, pilis patentibus griseis crispis attenuatis; glandulis vel nullis vel inter pilos eglandulares obscuris; aliter habitu et foliis etc. var. *typicae* simillima et similiter variabilis. (FIG. 58 *β*.)

FIG. 59. B. Parryi.

Eupatorium nepetaefolium HBK. Nov. Gen. et Spec. iv. 112 (1820).
Bulbostylis nepetaefolia (HBK.) DC. Prod. v. 139 (1836).
Brickellia Cavanillesii auct. pro parte, sed non *Coleosanthus Cavanillesii* Cass.

MEXICO: GUANAJUATO: locis siccatis montium Santa Rosa, alt. 2380 m., *Humboldt & Bonpland*, n. 4233 (hb. Par., phot. in hb. Gray.); prope urbem Guanajuato, *Dugès*, nn. 7 (hb. Gray.), 429 (hb. Gray.). MICHOACAN: ad Quinceo prope Moreliam, *Arsène* (hbb. Gray., Univ. Calif.). JALISCO: collibus exsiccatis prope Guadalajaram, *Palmer* (anno 1886), n. 485 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.), *Pringle*, nn. 1790 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.), 11,492 (hbb. Gray., U. S.). ZACATECAS: ad Real de Pinos, *Diquet* (hb. N. Y.). CIV. IGNOT.: *Graham* (hb. Gray.).

NOTA. — Inter *B. secundifloram* et *B. tomentellam* stare videtur specimen unicum (L. C. Smithii, n. 920, prope Pueblam lectum in hb. Grayano servatum). An planta hybrida?

56. B. PARRYI Gray, Proc. Am. Acad. xv. 31 (1879)

Subherbacea vel distincte fruticosa multis speciei praecedenti simillima differt praecipue capitulis paullo minoribus 10–12(–14) mm. altis ca. 20–25-floris; involucri squamis saltem intermediis et saepissime etiam intimis obtusis vel obtusiusculis. (FIG. 59.)

Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881).
Coleosanthus Parryi (Gray) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT.: SAN LUIS POTOSI: lat. 22°, alt. 1830–2449 m., *Parry & Palmer*, nn. 350 (hbb. Gray., Mo., U. S.), 363 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.); in arenosis, *Schaffner*, n. 365 (hb. Gray.), *Schaffner* (anno 1880), sine numero (hb. Gray.); *Ward* (hb. U. S.); sine loco exactiore, *Orcutt*, n. 5124 (hb. Mo.). ZACATECAS: ad Real de Pinos, *Diquet* (hb. N. Y.).

NOTA. — Haec species (valde variabilis et minus cognita) folia parva et magna, pedicellos brevissimos rectos vel ca. 1 cm. longos filiformes flexuosos exhibet. Quamquam formae nonnullae ob his characteribus distingueri possunt tamen formae ejusmodi minime valent et verisimiliter plerumque ab conditionibus meteorologicis penderent modo plantarum in desertis et locis irregulariter cum pluviis satis factis incolarum. Varietates duae sequentes tamen ob pubescentia differente recognoscendae.

Var. *α.* **typica,** foliis subtus non solum in nervis venisque sed etiam in facie griseo- vel albido-tomentosis. — Synon. et distrib. et exsicc. ut supra dictae. (FIG. 59.)

Var. *β.* **micacea,** var. nov., foliis subtus solum in nervis venisque breviter pubentibus, in facie glabrescentibus et cum glandulis sessilibus numerosis sub lente pulchriter lucentibus obsitis.

MEXICO CENT.: SAN LUIS POTOSI: ad Alvarez, *Palmer* (anno 1902), n. 148 (hbb. Gray., Mo., N. Y.).

57. B. TOMENTELLA Gray, Pl. Wright. i. 85 (1852)

Elata 1.5–2.5 m. alta; caulibus molliter lignescentibus medullosis tomentellis; foliis suboppositis late ovatis plerisque cordatis crenato-serratis subacutis vel rare

ad apicem rotundatis bene petiolatis supra puberulis rugosis subtus canescenti-tomentosis 4–6 cm. longis 3–4.5 cm. latis, petiolo ad 1.5 cm. longo; capitulis 21–32-floris 13–15 mm. altis in paniculam densiusculam folioso-bracteatam saepius secundum dispositis graciliter pedicellatis saepe nutantibus; corollis 8.5 mm. longis sine faucibus ullis evidentibus; achaeniis 4 mm. longis sursum hispidulis; · pappi setis ca. 35 tenuiter capillaribus laete albis barbellatis; involucri squamis plerumque viridi-stramineis obtusissimis marginem versus tenuissimis scareosis post exsiccationem undulato-crispis. (FIG. 60.)

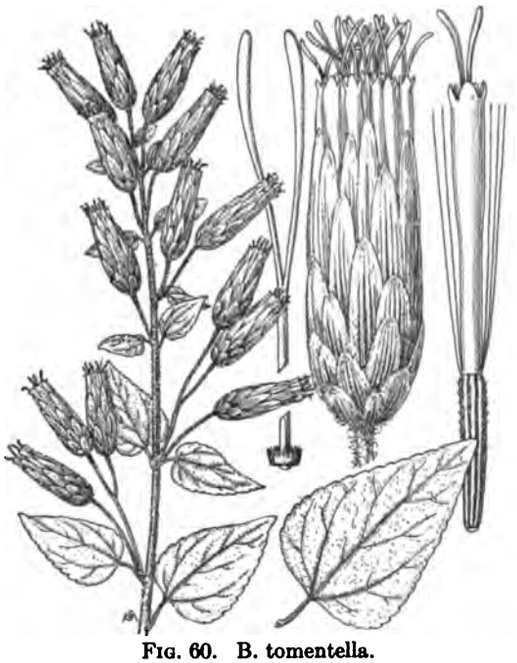

FIG. 60. B. tomentella.

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881). *Coleosanthus tomentellus* (Gray.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO AUST.: sine loco exactiore, *Tate* (hb. Kew., fragm. in hb. Gray.), *Vischer*, n. 81 (hb. N. Y.); *Mairet* fide Hemsl. l. c. OAXACA: in valle ita nominata, alt. 1586 m., *Pringle*, n. 6172 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.); ad Ocotlan, alt. 1500 m., *Conzatti & González*, n. 1265 (hb. Gray.); prope Mitlam, alt. 1525 m., *C. L. Smith*, n. 375 (hbb. Mo., N. Y., U. S.). MEXICO: ad Amecamecam, *Purpus*, n. 1560 (hbb. Gray., Univ. Calif., N. Y., U. S.), *Holway*, n. 3767 (hb. Gray.) forma foliis obtusissimis; ad Chapultepec, *Schaffner* (hb. Gray.) forma foliis basi rotundatis non cordatis subtus minus dense tomentosis. PUEBLA: secundum vias ad Esperanzam, *Purpus*, n. 2634 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

58. B. LANCIFOLIA Robinson & Greenman, Am. Jour. Sci. ser. 3, l. 153 (1895)

FIG. 61. B. lancifolia.

Fruticosa 1.5–2.5 m. alta; caulibus teretibus fulvo-tomentellis virgatis foliosis; foliis oppositis petiolatis subintegris exacte lanceolatis apice attenuatis basi acutis coriaceis supra scaberrimis rugosis subtus reticulato-venosis primo griseo-tomentellis

maturitate inconspicue puberulis 5–7 cm. longis 2–2.5 cm. latis; capitulis bene pedicellatis in cymis laxis axillaribus saepissime nutantibus conjunctim paniculam elongatam gracilem formantibus 10–12-floris ca. 20 mm. altis; involucri squamis purpurascentibus 5–8-striatis plerisque obtusis mucronulatis; corollis fere 1 cm. longis; achaeniis 5 mm. longis sericeis. (FIG. 61.)

MEXICO AUST.: OAXACA: in Sierra San Felipe, *Pringle*, n. 6109 (hbb. Gray., Mo., J. D. Sm., Phil., U. S., Arn. Arb.).

59. **B. nutans** (HBK.), comb. nov.

Herbacea erecta 1–3 m. alta tenuiter pubescens foliosa floribunda; caule purpureo vel brunneo crispe puberulo; foliis caulinis alternis ovato- vel lanceolato-oblongis longe acutatis serratis tenuibus supra viridibus laeviusculis subtus pallidioribus in nervis venisque tomentellis 4–6 cm. longis 2–2.5 cm. latis supra basin subpinnatim 3–7-nerviis, petiolo 2–12 mm. longo; foliis rameis plerisque oppositis; capitulis ca. 15 mm. altis 7 mm. diametro ca. 20-floris graciliter pedicellatis in ramulis plerumque 3–5-capitulatis valde nutantibus conjunctim inflorescentias virgatas elongatas secundas vel paniculam pyramidatam formantibus; involucri squamis ca. 30 tenuibus laxe imbricatis valde inaequalibus plerisque obtusis glabriusculis; corollae dentibus extus glandulosis; achaeniis 5 mm. longis sursum hispidulis; pappi setis albis barbellatis. — Species australi-mexicana floribunda habitu elegans diu infeliciter cum *B. pendula* confusa tamen bene distincta. (FIG. 62.)

FIG. 62. B. nutans.

Eupatorium nutans HBK. Nov. Gen. et Spec. iv. 105 (1820); Robinson, Proc. Am. Acad. xlii. 43 (1906), ubi per errorem ad *B. pendulam* (Schrad.) Gray incaute reducta.

MEXICO AUST.: Civ. MEXICO et TERR. FOED.: in desertis Vieja, *Bourgeau*, n. 1227 (hbb. Gray., U. S.); Serrania de Ajusco, alt. 2900 m., *Pringle*, n. 11,496 (hbb. Gray., U. S.); in silvis prope Guapimalpon, *Schaffner* (hb. Gray.); in silvis ad Eslavam, alt. 2290 m., *Pringle*, n. 8059 (hbb. Gray., Mo., J. D. Sm., N. Y., Phil., U. S., et partim Univ. Calif.); in valle Mexico, *Pringle*, n.

7350 (hb. Gray.); inter Tolucam et Tianguillo, alt. 2750 m., *Humboldt & Bonpland*, n. 4374 (hb. Par., phot. in hb. Gray.); locis apertis siccis, Ixtaccihuatl, *Deam*, n. 129 (hb. Gray.), *Purpus*, n. 1559 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.). MICHOACAN: in montibus prope Patzcuaro, *Pringle*, n. 5055 (hb. Gray.).

60. B. ORIZABENSIS Klatt, Ann. Naturh. Hofmus. Wien, ix. 358 (1894)

Herbacea vel basi lignescens erecta 1.5–2.5 m. alta; caulibus atropurpureis crispe puberulis; ramis gracilibus adscendentibus; foliis oppositis late ovatis crenatim vel argute serratis basi cordatis supra viridibus obscure puberulis subtus pallidioribus in nervis venisque tomentellis 4–7 cm. longis 2.5–5.3 cm. latis a basi 3-nerviis; inflorescentia ut apud praecedentem; capitulis ca. 14-floris; involucri squamis ca. 25 dorso tenuiter villosis. — Species australi-mexicana praecedenti primo aspectu simillima tamen foliis caulinis oppositis latioribus facile distinguenda. (FIG. 63.)

FIG. 63. B. orizabensis.

Brickellia nutans Robinson & Greenman, Am. Jour. Sci. ser. 3, 1. 152 (1895).

MEXICO AUST.: VERA CRUZ: Orizaba, *F. Mueller*, n. 1293 (hbb. Gray., N. Y.). OAXACA: in Sierra de San Felipe, alt. 3050 m., *Pringle*, n. 6114 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S., Arn. Arb.); ad Santa Inés del Monte, Zimatlan, alt. 2500 m., *Conzatti*, n. 1332 (hb. Gray.). GUERRERO: prope Chilpancingo, alt. 2745–3111 m., *E. W. Nelson*, n. 2218 (hbb. Gray., U. S.).

61. B. PENDULA (Schrad.) Gray, Pl. Wright. i. 85 (1852), quoad syn. nominiferum

Fruticosa 2–3 m. alta superne ramosa; ramis plerisque oppositis juventate dense glandulari-puberulis tardius solum paullo scabridis; glandulis stipitatis eleganter purpureis; foliis oppositis (rarius alternis) oblongo-ovatis vel -lanceolatis acutis vel obtusis basi rotundatis vel subcuneatis crenato-serratis vel integriusculis saepius crassis coriaceis supra scabris viridibus saepe rugosis subtus plus minusve pallidioribus reticulato-venosis sparse hirtellis vel tomentellis paullo supra basin 3–5-nerviis 2.5–8 cm. longis 1.5–4 cm. latis, petiolo 6–14 mm. longo; capitulis 2 cm.

altis 6 mm. diametro ca. 12-floris suberectis vel nutantibus vel quasi pendulis in cymulis plerisque oppositis 1–3-capitulatis ex axillis superioribus orientibus conjunctim inflorescentiam vel racemiformem vel ramosiorem formantibus; pedicellis 5–23 mm. longis cum glandulis atropurpureis stipitatis dense obsitis; involucri squamis lanceolato-linearibus acutis 6–8-striatis laxe imbricatis viridibus vel saepius partim purpureo- vel brunneo-tinctis glandulari-puberulis vel atomiferis, extimis paullo squarrosis; corollis 12 mm. longis; achaeniis 5.5 mm. longis sericeis non glanduliferis; pappi setis ca. 45 laete albis barbellatis 9 mm. longis. (FIGG. 64, 65.)

Eupatorium pendulum Schrad. Ind. Sem. Hort. Goett. 1830, & Linnaea, vi. Litteraturb. 72 (1831).
Bulbostylis pendula (Schrad.) DC. Prod. v. 138 (1836).
Eupatorium scariosum Wallr. ex DC. l. c. in synon. (1836).
Coleosanthus pendulus (Schrad.) Ktze. Rev. Gen. i. 328 (1891).

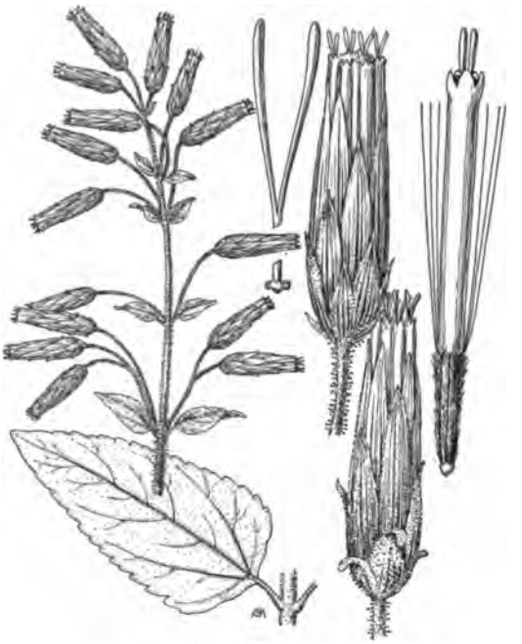

FIG. 64. B. pendula.

FIG. 65. B. pendula, var. squarrosa.

MEXICO AUST.: sine loco exactiore, *Schiede* (hb. DC., phot. in hb. Gray.). OAXACA: Sierra de San Felipe, alt. 2135 m., *Pringle*, n. 5697 (hbb. Gray., U. S.), *C. L. Smith*, n. 383 (hbb. Gray., Mo., U. S.); in silvis saxosis quercorum, alt. 2287 m., *Pringle*, n. 6167 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.); Etla, alt. 1900 m., *Conzatti*, n. 2078 (hb. Gray.). MEXICO ad Amecamecam, *Goodding*, n. 2172 (hb. Univ. Calif.). TERR. FOED.: in silvis ad Eslavam, alt. 2290 m., *Pringle*, n. 8059 pro parte (hb. Univ. Calif.). MORELOS: in silvis montanis supra Cuernavacam, alt. 2287 m., *Pringle*, n. 8016 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.). CIV. IGNOT: in silvis apertis, Salto de Agua, alt. 2180–2240 m., *Purpus*, n. 1561 (hbb. Gray., Mo., N. Y., U. S.); declivitatibus siccatis montis Ixtaccihuatl, *Purpus*, n. 41 (hbb. Mo., Univ. Calif., U. S.).

Var. α. **typica,** involucri squamis omnibus appressis vel extimis paullulo squarrosis. — Synon. et distrib. et exsicc. ut supra dictae. (FIG. 64.)

Var. β. **squarrosa** (Robinson & Seaton), comb. nov., involucri squamis intermediis et exterioribus apicem versus subherbaceis valde conspicueque squarrosis. (FIG. 65.)

Brickellia squarrosa Robinson & Seaton, Proc. Am. Acad. xxviii. 108 (1893).

MEXICO: MICHOACAN: in montuosis prope Patzcuaro, *Pringle*, n. 5054 (hb. Gray.).

NOTA. — Haec planta primo aspectu ob involucro conspicue squarroso a *B. pendula* multo diversa videri possit, sed speciminibus multis var. *typicae* examinatis nonnulla reperta sunt cum involucri squamis plus minusve quamquam minus conspicue apicem versus herbaceis et extimis saltem aliquid squarrosis qua de causa melius videtur *B. squarrosa* Robinson & Seaton adhuc ab specimine unico solo cognita in loco formae extremae hujus variationis quam pro speciei omnino distincta tractare. Id quod verisimilius est quum involucro excepto hae plantae omnibus simillimae sint.

62. B. SEEMANNI Gray, Proc. Am. Acad. xv. 30 (1879)

Herbacea perennis vel fortasse plus minusve lignescens (basi ignota) scabrido-puberula; pilis brevissimis prorsus curvatis; foliis ovatis crenato-serratis basi rotundatis 3–4.5 cm. longis 1.5–3 cm. latis utrinque pallide viridibus subtus reticulatis, petiolo 3–8 mm. longo; capitulis ca. 15-floris 18 mm. altis 8 mm. diametro brevissime pedicellatis valde nutantibus ad apicem caulis breviter secundeque recemosis; involucri squamis ca. 25 stramineis anguste lanceolatis peracutis apice plus minusve aristato-mucronatis 4–5-striatis; receptaculo obscure hirtello; corollis 7.5 mm. vel ultra longis; achaeniis sursum villoso-sericeis 2.3 mm. longis (immaturis); pappi setis ca. 60 aequalibus albis tenuiter capillaribus barbellatis. — Species bene distincta semel lecta a loco non exacte indicato et ut videtur nunquam reperta. (FIG. 66.)

FIG. 66. B. Seemanni.

Hemsl. Biol. Cent.-Am. Bot. ii. 107 (1881).
Coleosanthus Seemanii [Gray] Ktze. Rev. Gen. i. 328 (1891).

MEXICO BOR.-OCC.: in Sierra Madre, *Seemann*, sine numero (hb. Gray.).

63. B. SALTILLENSIS Robinson, Proc. Am. Acad. xliii. 37 (1907)

Herbacea vel paullo lignescens (basi non visa) tenuiter scabrido-pubescens 9–12 dm. alta; caulibus ut videtur erectis virgatis foliosis; foliis alternis vel subopositis graciliter petiolatis ovatis subacutis crenatis utrinque viridibus tenuibus sed paullo firmiusculis non coriaceis leviter reticulatis basi rotundatis vel rarius

abrupte breviterque angustatis 4–6 cm. longis 2.5–3.5 cm. latis, petiolo 6–11 mm. longo; axillis plerisque proliferis, foliis gemmarum elliptico-oblongis ca. 1 cm. longitudine; capitulis 14–16-floris 17 mm. altis 6 mm. diametro; pedicellis filiformibus flexuosis 4–9 mm. longis glanduloso-puberulis; involucri squamis ca. 22 lanceolato-linearibus attenuatis peracutis viridibus vel purpureo-tinctis 4–6-striatis; corollis ca. 1 cm. longis viridi-albis; achaeniis brunneo-fuscis 4.5 mm. longis sursum villoso-sericeis; pappi setis ca. 40 laete albis vix barbellatis. (FIG. 67.)

FIG. 67. B. saltillensis.

MEXICO BOR.: COAHUILA: in montuosis prope Saltillo, alt. 2135 m., *Pringle*, n. 10,082 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.).

64. B. ODONTOPHYLLA Gray, Proc. Am. Acad. xvii. 206 (1882)

Herbacea ut videtur erecta virgata vel ramosa puberula 6–9 dm. alta; ramis gracilibus adscendentibus; foliis alternis vel subopositis deltoideo-ovatis, caulinis grosse crenato-dentatis tenuibus late cordatis plerisque obtusis inconspicue puberulis, petiolo 1.5–2 cm. longo; foliis rameis multo minoribus ovato-oblongis saepe acutis; capitulis ca. 23-floris ca. 17 mm. altis 6 mm. diametro valde nutantibus; racemis secundis; involucri squamis lanceolato-linearibus attenuatis laxe imbricatis 4–6-striatis; corollis albis limbum versus flavidis 8 mm. longis; achaeniis 4 mm. longis hispidulis; pappi setis ca. 36 albis vix barbellatis. (FIG. 68.)

FIG. 68. B. odontophylla.

MEXICO BOR.-CENT.: COAHUILA: in vallibus praeruptis et in locis exaltatis a Saltillo ad aust. spect., *Palmer* (anno 1880), n. 442 (hbb. Gray., J. D. Sm., Phil., U. S.). DURANGO: in vallicula praerupta hispanice "barranca" dicta prope stationem viae

ferreae Sandiam, alt. 2135 m., Pringle, n. 10,101 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.). CHIHUAHUA: prope Parral, *Goldman*, n. 129 (hbb. Gray., N. Y., U. S.); inter San Julian et Cerro Prieto, alt. 2135–2592 m., *E. W. Nelson*, n. 4955 (hb. U. S.).

NOTA. — Haec species habitu foliis pubescentia flosculis *B. simplici* persimilis differt tamen capitulis multo minoribus plerumque numerosioribus involucro cylindrico ca. 6 mm. diametro non campanulato ca. 11 mm. diametro. Quamquam varietas parvi-capitulata *B. simplicis* videri possit formae intermediae hucusque nunquam repertae sunt.

65. **B. argyrolepis,** spec. nov.

Fruticosa ramosa molliter lignescens 2–3 m. alta griseo-pubescens vel -tomentella; caulibus teretibus medullosis flavido-griseis vel brunnescentibus juventate tomentellis maturitate glabratis; foliis oppositis submembranaceis ovatis acutis basi rotundatis vel subtruncatis vel leviter lateque cordatis 4–6 cm. longis 2–4 cm. latis serrulatis subtus pallidioribus molliter tomentellis, petiolo 1–2 cm. longo; capitulis ca. 24-floris 20 mm. altis 7 mm. diametro ad apices ramorum glomeratis; glomerulis maturitate saepius subglobosis; involucri subcylindrici squamis ca. 28 lineari-lanceolatis argenteo-sericeis attenuatis subscareis; corollis 1 cm. longis; achaeniis 5.5 mm. longis brunneis hispidulis et cum glandulis paucis inconspicuis obsitis; pappi setis ca. 35 albis deciduis vix scabridis. — Species costaricensis constans et facile recognoscere. (FIG. 69.)

FIG. 69. B. argyrolepis.

Brickellia Hartwegi Klatt, Bull. Soc. Bot. Belg. xxxi. pt. 1, 196 (1892); J. D. Smith, Enum. Pl. Guat. iv. 77 (1895); non Grayi.

COSTA RICA: in sepibus ad San Rafael, *Pittier*, n. 1980 (hbb. Gray., J. D. Sm.); ad San José, alt. 1160 m., *Tonduz*, n. 17,465 (hb. Gray.); prope San Marcos, alt. 1355 m., *Tonduz*, nn. 7710 (hb. Mo.), 7762 (hbb. Gray., J. D. Sm.); in dumetis ad Copey, alt. 1800 m., *Tonduz*, n. 11,847 (hb. Gray.); Agua Caliente, prov. Cartago, alt. 1190 m., *J. D. Smith*, n. 4859 (hbb. Gray., J. D. Sm.); sine loco exactiore, *Worthen* (hb. Mo.).

66. **B. squarrosa** (Cav.), comb. nov.

Fruticosa elata patenter oppositiramea ad 3 m. alta; caulibus ramisque adscendentibus flexuosis molliter lignosis medullosis pallide brunneis primo minute

griseo-puberulis maturitate glabratis; foliis oppositis orbiculari-ovatis cordatis acuminatis crenato- vel arguti-serratis tenuibus primo griseo-puberulis vel -tomentellis deinde utrinque viridibus et obscure hirtellis glandulari-atomiferis 4–9 cm. longis 2–7 cm. latis basi rotundatis vel subtruncatis vel saepissime cordatis, petiolo gracili ad 4 cm. longo; capitulis ca. 25-floris 17 mm. altis 7 mm. diametro in cymis (paniculatim aggregatis) axillaribus pedunculatis 3–pluri-capitulatis laxis nutantibus; pedicellis filiformibus glandulari-puberulis vel rarissime non glandularibus et breviter hispidulis; bracteolis parvis ovato-lanceolatis pedicello multo brevioribus; involucri squamis lanceolato-linearibus attenuatis tenuibus dorso saepissime glandulari-puberulis, exterioribus saepissime apicem versus squarroso-patentibus; corollis viridi-flavis ca. 1 cm. longis; achaeniis 5.5 mm. longis nigrescentibus sparse hispidulis et dense glandulosis; pappi setis ca. 37 albis aequalibus caducis. (FIG. 70.)

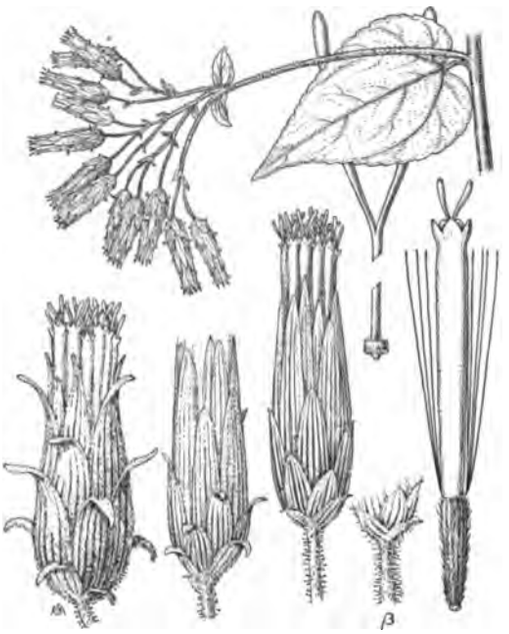

FIG. 70. B. squarrosa.

Eupatorium squarrosum Cav. Ic. i. 66, t. 98 (1791).
Coleosanthus Cavanillesii Cass. Bull. Soc. Philom. 1817, p. 67 (1817), & Dict. x. 37 (1818).
Rosalesia glandulosa La Llav. in La Llav. & Lex. Nov. Veg. Descr. 9 (1824).
Eupatorium Rosalesia DC. Prod. v. 183 (1836).
Bulbostylis Cavanillesii (Cass.) DC. Prod. v. 138 (1836), solum quoad synon. nominiferum.
Ismaria glandulosa (La Llav.) Raf. Sylv. Tellur. 117 (1838).
Brickellia Cavanillesii (Cass.) Gray, Pl. Wright. i. 85 (1852), solum quoad synon. nominiferum.
Brickellia Rosalesia (DC.) Benth. & Hook. f. ex Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881).
Coleosanthus glandulosus (La Llav.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT. et AUST.: DURANGO: ad San Ramon, *Palmer* (anno 1906), n. 53 (hbb. Gray., Mo., Field Mus., N. Y., U. S.). JALISCO: prope San Sebastian, alt. 1150–1525 m., *E. W. Nelson*, n. 4089 (hbb. Gray., U. S.). MICHOACAN seu GUERRERO: ad Los Magueyes, alt. 1800 m., *Langlassé*, n. 58 (hbb. Gray., U. S.); in terris graniticis, Sierra Madre, alt. 1900 m., *Langlassé*, n. 856 (hb. Gray.). MICHOACAN: in declivitate montis Tancitaro prope Perivan, *E. W. Nelson*, n. 6875 (hb. U. S.). PUEBLA: in sepibus ad urbem ita nominatam, *Pringle*, n. 7020 (hb. Gray.). CIV. MEXICO: prope Atlacomules, reg. temp., *Schiede*, n. 1539 (hb. U. S.).

NOTA. — Haec species primo a cl. Cavanillesio sub nomine *Eupatorio squarroso* descripta illustrataque et tardius a cl. Cassini sub nomine *Coleosantho Cavanillesii* est semper dubitativa et saepius errone interpretata, tamen e speciminibus recentioribus cum descriptione et icone Cavanillesii in toto optime quadrantibus nunc definitiva facienda est. Involucri squamae sunt saepe vere

distincteque squarrosae. Id quod cl. Candolleus ex herb. Cavanillesii recipuit erat ut videtur planta omnino distincta verisimiliter forma *B. secundiflorae.*

NOMEN VULGATUM: hispanice " Cabecona amarilla " f. Langlassei.

Var. α. **typica,** pedicellis copiose conspicueque glandulari-puberulis cum vel absque pilis paucis eglandularibus inconspicuis; involucri squamis exterioribus glandulari-granulosis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **oligadena,** var. nov., pedicellis griseo-pubescentibus, pilis albis patentibus attenuatis minute nodulosis aut omnibus aut maxima ex parte eglandularibus sed cum glandulis globosis paucis subsessilibus vel stipitatis inconspicue interspersis; involucri squamis exterioribus griseo-pubescentibus nec glandulari-granulatis. (FIG. 70 β.)

FIG. 71. B. guatemalensis.

MEXICO CENT.: MICHOACAN: Hacienda Coahuayula, Feb. 1901, *Dr. G. M. Emrick,* n. 132 (spec. typ. in hb. Field Mus., fragm. in hb. Gray.).

67. **B. guatemalensis,** spec. nov.

Herbacea perennis; caule tereti folioso superne oppositirameo brunneo crispe griseo-tomentello tardius glabrato; foliis oppositis deltoideo-ovatis acutis vel acuminatis serrulatis vel subintegris membranaceis basi rotundatis vel subtruncatis supra adpresse villosulis subtus paullo pallidioribus griseo-pubescentibus 5–8 cm. longis 3–4.5 cm. latis, petiolo 2–3.5 cm. longo; capitulis ca. 15 mm. altis 7 mm. diametro ca. 20-floris ad apices ramorum densiuscule corymbosis; corymbis 3–10-capitulatis valde convexis saepius erectis; involucri cylindrico-campanulati squamis ca. 30 lanceolato-linearibus vel lanceolatis (extimis ovatis) viridibus acutis dorso griseo-tomentellis; achaeniis ca. 5 mm. longis brunneis hispidulis et cum glandulis subsessilibus globosis obsitis. (FIG. 71.)

GUATEMALA: dept. Alta Verapaz, in montibus inter Coban et Tactic, alt. 1600 m., *von Tuerckheim,* n. II. 2145 (hbb. Gray., Mo., J. D. Sm., N. Y., U. S.).

68. **B. Botterii,** spec. nov.

Fruticosa ramosa; caulibus ramisque teretibus primo tomentellis deinde glabrescentibus; foliis oppositis ovato-deltoideis vel -oblongis tenuibus leviter crenato-serratis 4–6 cm. longis 2–4 cm. latis supra viridibus crispe puberulis subtus molliter griseo-tomentosis a basi 3-nerviis apice acuminatis basi plerumque rotundatis vel subcordatis, petiolo 1–3 cm. longo; panicula pyramidali 3–4 dm. longa 2 dm. diametro foliaceo-bracteata, ramis adscendentibus apice corymbiferis, corymbis particularibus densiusculis 4–11-capitulatis valde convexis; pedicellis gracilibus atropurpureis glandulari-puberulis 5–8 mm. longis; capitulis ca. 16-floris vix 14 mm. altis cylindricis; involucri squamis ca. 19 appressis purpurascentibus acuminatis vel attenuatis tenuissime lanulosis et (praecipue extimis) glandulari-granulosis, intimis linearibus, intermediis gradatim brevioribus lanceolatis, extimis ovatis 3–5-striatis; corollis 8 mm. longis; achaeniis 4.3 mm. longis hispidis; pappi setis ca. 35 albis minute scabratis corollam subaequantibus. (Fig. 72.)

Fig. 72. B. Botterii.

MEXICO AUST.: Vera Cruz: Orizaba, *Botteri*, nn. 1112 (spec. typ. in hb. Gray.; etiam U. S. ubi sub sched. cl. C. Mohrii qui cum cl. Botterio aliquando associatus erat), 1115 pro parte (hb. U. S. ubi cum *B. pacayense* commixta), sine numero (hb. Gray.).

69. **B. adenocarpa,** spec. nov.

Perennis paullo lignescens; caulibus teretibus ramosis saepius brunneis primo crispe puberulis maturitate glabrescentibus, internodiis longis; ramis gracilibus late patentibus; foliis oppositis ovatis acute acuminatis subtiliter crenato-serratis supra pallido-viridibus puberulis subtus multo pallidioribus molliter griseo-tomentellis 3.5–5.4 cm. longis 2–3.5 cm. latis basi rotundatis vel subcordatis, petiolo 8–20 mm. longo; capitulis ca. 22-floris 18 mm. altis 6 mm. diametro ad apices

ramorum in corymbos valde convexos densiusculos dispositis; pedicellis 5–15 mm. longis griseo-tomentosis vel (var. β) glandulari-puberulis; involucri campanulato-cylindrici squamis lanceolato-linearibus attenuatis nunc appressis nunc plus minusve squarrosis griseo-viridibus vel purpurascentibus 3–5-striatis, exterioribus gradatim brevioribus dorso molliter villosis vel (var. β) glandulari-puberulis; corollis 1 cm. longis ochroleucis plus minusve roseo-tinctis; achaeniis 5 mm. longis hirsutis et cum glandulis stipitatis vel subsessilibus dense obsitis; pappi setis albis deciduis minute barbellatis. (Fig. 73.)

Fig. 73. B. adenocarpa.

Brickellia Cavanillesii Coult. in J. D. Smith, Enum. Pl. Guat. ii. 35 (1891), non Grayi sensu strictiore.

MEXICO AUST.: Oaxaca: Rancho de Calderon, alt. 2075 m., *L. C. Smith*, n. 378 (spec. typ. in hb. Gray.); in Cordillera, alt. 1525 m., *Galeotti*, n. 2073 (hb. Gray.).

GUATEMALA: dept. ita nominat., alt. 1525 m., *J. D. Smith*, n. 2402 (hbb. J. D. Sm., U. S., et maxima ex parte hb. Gray.), *Holway*, n. 466 (hb. Gray.); alt. 1465 m., *Kellerman*, n. 4574 (hb. U. S.); in monte ignivomo Agua, dept. Sacatepéquez, alt. 2745 m., *Kellerman*, n. 4767 (hb. U. S.); ad Sololam, *Holway*, n. 151 (hb. Gray.); Santa Rosa, ad Carrizal, alt. 1525 m., *Heyde & Lux* (distrib. J. D. Sm.), n. 4201 (hb. Mo. et ex parte hb. U. S.).

Var. α. **typica,** pedicellis et involucri squamis exterioribus griseo-villosis vel -tomentosis non glandulosis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **glandulipes,** var. nov., habitu et foliis etc. var. *typicae* simillima differt pedicellis brevissime glandulari-puberulis nec griseo-tomentosis; involucri squamis exterioribus etiam sordide cum glandulis sessilibus vel subsessilibus dense obsitis. — Varietas saepius facile distinguenda sed nonnunquam certe in var. α transiens. (Fig. 73 β.)

Brickellia Cavanillesii Coult. in J. D. Smith, Enum. Pl. Guat. iv. 77 (1895), non Grayi sensu strictiore.

MEXICO AUST.: Chiapas: in silvis montanis inter San Martin et Ococingo, *C. & E. Seler*, n. 2129 (hbb. J. D. Sm., N. Y.), specimen defectum et dubitativum.

GUATEMALA: ad Quezaltenango, alt. 2287 m., *E. W. D. Holway*, n. 92 (spec. typ. in hb. Gray.); ad Carrizal, dept. Santa Rosa, alt 1525 m., *Heyde & Lux* (distrib. J. D. Sm.), n. 4201 (hb.

Gray.); ad urbem Guatemalam, alt. 1525 m., *J. D. Smith*, n. 2402 minima ex parte (hb. Gray.), alt. 1465 m., *Kellerman*, n. 5333 pro parte (hb. Field Mus.).

70. B. PACAYENSIS Coult. Bot. Gaz. xvi. 98 (1891)

Suffrutescens vel vere fruticosa erecta molliter griseo-pubescens vel -tomentosa superne glandulosa 1–3 m. alta; foliis oppositis deltoideo-ovatis crenatis acutiusculis a basi 3-nerviis 4–7 cm. longis 3–4 cm. latis basi rotundatis vel subcordatis supra pallide viridibus scabro-puberulis subtus griseo-tomentosis reticulatis, petiolo 1–2 cm. longo; capitulis 22–25-floris 11–12.5 mm. altis 6–8 mm. diametro in paniculam foliosam vel dense vel laxe dispositis; bracteis lanceolato-oblongis brevissime petiolatis utroque acutis subintegris; pedicellis 1–2.5 cm. longis cum glandulis capitatis dense obsitis; involucri squamis lanceolati-oblongis plerisque acutis, extimis pro genere longis saepe interiores subaequantibus anguste vel latius oblongis (rarius spatulatis vel obovatis) dense sordideque glanduloso-puberulis; receptaculo hirtello; corollis 5.5–7 mm. longis; achaeniis 2.3–2.9 mm. longis sursum villosis et cum glandulis paucis vel nullis obsitis; pappi setis 40–45 albis brevissime barbellatis. — Species centrali-americana et australi-mexicana frequens quamquam habitu et inflorescentia et pubescentia aliquid variabilis tamen ex involucri squamis extimis praeter modum evolutis et sordide glandulosis facile recognoscenda. (FIG. 74.)

FIG. 74. B. pacayensis.

J. D. Smith, Enum. Pl. Guat. ii. 35 (1891), iv. 77 (1895).
Coleosanthus pacayensis Coult. Bot. Gaz. xx. 46 (1895).
Brickellia hebecarpoides Robinson, Proc. Am. Acad. xxxvi. 486 (1901), forma viridior cum panicula laxiore.

MEXICO AUST.: MICHOACAN: ad Los Reyes, *E. W. Nelson*, n. 6842 (hbb. Gray., U. S.); in monte ignivomo Jorullo, *E. W. Nelson*, n. 6954 (hbb. Gray., U. S.); in glareosis in monte de la Gloria, alt. 1150 m., *Langlassé*, n. 61 (hbb. Gray., U. S.). OAXACA: *Galeotti*, n. 2187 (hb. Gray.); ad Cuicatlan, alt. 550 m., *L. C. Smith*, n. 198 (hb. Gray.); Hacienda Guadelupe, alt. 1700 m., *Hugo & Conzatti*, n. 2489 (hbb. Gray., Field Mus.). MORELOS: secundum rivulos prope Cuerna-

vacam, alt. 1525 m., *Pringle*, nn. 6804 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.), 7332 (hb. Gray., fragm. in hb. U. S.), *Deam*, n. 14 (hb. Gray.). VERA CRUZ: in valle de Cordova, *Bourgeau*, n. 1974 (hb. Gray.) forma invol. squamis ext. paullo latioribus subobovato-oblongis; in monte Orizaba, *Botteri* (hb. Gray.); ad Zacuapan, *Purpus* (anno 1906), n. 1857 (hbb. Mo., Univ. Calif., N. Y., U. S.), etiam (anno 1909), n. 3653 (hb. Univ. Calif.).

GUATEMALA: ad Pacayam, dept. Amatitlan, alt. 1830 m. *J. D. Smith*, n. 2389 (hbb. Gray., J. D. Sm., Phil., U. S.); ad Teocinte, dept. Santa Rosa, alt. 762 m., *Heyde & Lux* (distrib. J. D. Sm.), n. 4218 (hbb. Gray., J. D. Sm., U. S.).

SAN SALVADOR: prope oppidum ita nominatum, *Velasco* (distrib. J. D. Sm.), 8900 (hbb. Gray., J. D. Sm.).

NICARAGUA: in monte ignivomo El Viejo, *Baker*, n. 2163 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

NOTA. — Variat conspicuiter, foliis aut crassis densius griseo-velutinis aut tenuioribus viridibus minus pubescentibus, panicula aut densa aut laxa, involucri squamis exterioribus aut anguste lanceolati-oblongis aut subobovato-oblongis densissime sordido-glandulosis aut (rarius) sparse et inconspicue glandulosis. Formae hae omnes tamen valde inconstantes minime valent.

NOMEN VULGATUM: hispanice " mustranto " f. Langlassei.

71. B. FLORIBUNDA Gray, Pl. Wright. ii. 73 (1853)

Suffrutescens 1–1.5 m. alta ramosa puberula aromatica superne glandulosa et viscida; caule tereti pallide viridi vel griseo-brunnescente medulloso molliter lignescente juventate saepe purpureo-maculato; foliis alternis deltoideo- vel rhombeo-ovatis acutis irregulariter paucidentatis concoloribus 3-nerviis 4–13 cm. longis 3–9 cm. latis utrinque plus minusve (saepe obscure) glanduloso-puberulis et viscidis; panicula alterniramea ovoidea multicapitulata 2–4 dm. dametro; capitulis 1 cm. altis 4.2 mm. diametro ca. 15-floris; involucri squamis ca. 22 oblongis apice rotundatis paullulo mucronulatis 3–4-striatis, interioribus substramineis glabris, extimis ovato-lanceolatis acutis subherbaceis glandulari-hirtellis saepissime una vel pluribus plus minusve elongatis; corollis pallidis ochroleucis vel viridi-albis; achaeniis nigrescentibus sursum griseo-villosulis non glanduliferis 2 mm. longis; pappi setis ca. 35 albis barbella-

FIG. 75. B. floribunda.

tis. — Species inornata bene distincta in Civ. Foed aust.-occ. et Mex. bor. communis. (FIG. 75.)

Gray, Syn. Fl. i. pt. 2, 105 (1884).
Brickellia Wrightii Rothr. in Wheeler, Rep. vi. 140 (1878), non Grayi.
Coleosanthus floribundus (Gray) Ktze. Rev. Gen. i. 328 (1891).
Brickellia floribunda, var. *amblyolepis* Gray ex Pringleo, Pl. Mex. 1885, p. 2 (sine numero) nunquam descripta non differt.

NEO-MEXICO: ad San Lorenzo, Sierra com., alt. 1680 m., *Metcalfe*, n. 1474 (hbb. Mo., U. S.); prope urbem Silver nominatam, *Greene* (hbb .Mo., Jns.); in montibus Burro dictis, Grant com., *Rusby*, n. 239 (hbb. Mo., J. D. Sm.); in montibus anglice Dog nominatis, *Mearns*, n. 2344 (hb. U. S.).

ARIZONA AUST.: secundum flumen Black dictum, alt. 1372 m., *Rothrock*, n. 793 (hbb. Gray., U. S.); ad castellum Lowell, alt. 732 m., *Thornber*, n. 95 (hbb. Mo., N. Y., U. S., Jns.); ad Bowie, *Jones*, n. 4501 (hbb. N. Y., U. S., Arn. Arb., Jns.); prope Portal, *Eggleston*, nn. 10,662 (hb. U. S.), 10,663 (hb. U. S.), 10,915 (hb. U. S.), 10,920 (hb. U. S.), 11,006 (hb. U. S.); in locis calcareis et prope rivulos montium Chiricahua, alt. 1630–1680 m., *Blumer*, nn. N134 (hb. U. S.), U210 (hb. U. S.), 1766 pro parte (hbb. Gray., N. Y., U. S.), 2226 (hb. Gray.); ad Bisbee et vicin., *Mearns*, nn. 1035 (hb. U. S.), 1041 (hbb. N. Y., U. S.), 1089 (hb. U. S.); in montibus Chiricahua et Huachuca, *Lemmon*, n. 326 (hb. U. S.); in montibus Huachuca, *Jones* (hb. Jns.); in collibus prope montibus Santa Rita, *Engelmann & Sargent* (hb. Arn. Arb.); valliculis praeruptis petrosis montium Santa Catalina, *Pringle* (hbb. Gray., Mo., J. D. Sm., Phil., U. S.), *Lemmon*, n. 74 (hb. Gray.); ad angustias Apache, *Lemmon*, n. 365 (hb. Gray.); in montibus Maricopa, *Lemmon*, n. 73 (hb. Gray.); ad fontes anglice Walnut dictos, *Goodding*, n. 475 (hb. N. Y.); ad locum anglice Empire Ranch dictum *Griffiths & Thornber*, n. 289 (hb. U. S.).

MEXICO BOR.: CHIHUAHUA: prope urbem ita nominatam, *Pringle*, nn. 606 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S.), 934 (hbb. Mo., Univ. Calif.); circum Parral, alt. 1770 m., *Pringle*, n. 13,539 (hbb. Gray., U. S.); in planitiebus Santa Eulalia, *Wilkinson* (hbb. J. D. Sm., U. S.); ad coloniam Juarez, alt. 1586 m., *Jones* (hb. Jns.). SONORA: in valliculis prope Santa Cruz et ripis petrosis fluminis San Pedro, *Wright*, n. 1141 (hbb. Gray., Mo., Phil., U. S.).

SECT. 8. EUBRICKELLIA, SECT. NOV.

Capitula pro genere multi(28–62)-flora saepius (sed haudquaquam semper) magna. Pedicelli nunquam gemmiferi. Receptaculum calvum vel hirtellum. Corollae dentes brevissimi ovato-deltoidei. — Herbae perennes vel suffrutices vel frutices. Species 19, pleraeque mesophyticae rarius xerophyticae habitu variae rem publicam mexicanam et partem occidentalem Americae Borealis incolentes. Una sola in Civitatibus Foederatis austro-orientalibus indigena. Sectio ab sectionis *Bulbostylis* subsectione *Coleosantho* solum per characteres laevissimas separanda, tamen per classificationem commoda.

CLAVIS SPECIERUM

a. Capitula longe pedunculata. Involucri squamae extimae valde elongatae lanceolatae herbaceae una vel duae saepius squamas interiores aequantes vel eis longiores. Neo-Mex. ..... 72. *B. chenopodina.*

a. Capitula inter folia suprema sessilia, eis ellipticis integris involucrum exterius foliaceum formantibus ..... 73. *B. Greenei.*

a. Capitula pedicellata vel si sessilia sine involucro exteriore foliaceo *b.*

b. Pedicelli cum glandulis stipitatis obsiti *c.*

c. Folia sessilia vel subsessilia *d.*

d. Folia (pleraque alterna) ovata acuminata rigida spinoso-dentata *e.*

e. Involucri squamae extimae late ovato-oblongae integrae. Ramuli et pedicelli brevissime glandulari-puberuli quasi granulosi. Folia glandulari-atomifera laete viridia. Utah, Nev., Ariz. ..... 74. *B. atractyloides.*

e. Involucri squamae extimae angustiores ovati-lanceolatae nonnunquam dentatae rigidiusculae. Ramuli et pedicelli patentim pubescentes pilis saepe glanduloso-capitellatis. Folia glandulifera et praecipue in nervis venisque distincte hirtella obscura. Calif. aust. et infer. ..... 75. *B. arguta.*

d. Folia (pleraque alterna) elliptico-oblonga vel angustiora integra vel integriuscula ..... 76. *B. oblongifolia.*

d. Folia opposita ovata vel elliptico-oblonga conspicue crenato-serrata .... 77 *B. Wislizeni.*

c. Folia caulina breviter (ad 3-4 mm. longe) petiolata. Calif. infer. *f.*

f. Involucri squamae omnes acutae vel acutiusculae. Capitula ca. 30-flora 1 cm. alta. Achaenia 3 mm. longa ..... 78. *B. Brandegei.*

f. Involucri squamae intermediae et interiores obtusissimae apice rotundatae. Capitula ca. 47-flora 1.5 cm. alta. Achaenia 3.6 mm. longa .. 79. *B. macromera.*

c. Folia caulina longius (plerumque 1–2.5 cm. longe) petiolata *g.*

g. Folia subtus griseo-tomentosa. Capitula cymoso-paniculata 14 mm. alta. Pappi setae ca. 47. Calif. infer. ..... 80. *B. peninsularis.*

g. Folia subtus viridia solum puberula. Capitula 9–12 mm. alta. Pappi setae 14–30 *h.*

h. Folia serrato-dentata, dentibus plerisque acutis. Achaenia saepius 5–8-costata. Neo-Mex. et Ariz. ..... 86. *B. Fendleri.*

h. Folia integra vel grosse undulato-dentata. Achaenia 10-costata. Mex. *i.*

i. Folia late ovata cordata acuminata. Pappi setae 14–16. Mex. cent. ..... 81. *B. cardiophylla.*

i. Folia late rhombea obtusiuscula. Pappi setae ca. 30. Mex. bor.-occ. ..... 82. *B. rhomboidea.*

b. Pedicelli (saepius puberuli vel tomentelli) sine glandulis stipitatis evidentibus *j.*

j. Involucri squamae extimae (saepius ovatae vel lanceolatae) in appendices caudiformes attenuatae *k.*

k. Folia opposita. Pappi setae ca. 40 fulvo-purpurascentes. Civ. Foed. aust.-or. ..... 83. *B. cordifolia.*

k. Folia pleraque alterna. Pappi setae 19–28 albae. Mo. ad Brit. Columb. aust. et Mex. bor. ..... 84. *B. grandiflora.*

j. Involucri squamae extimae exappendiculatae *l.*

l. Pappi setae conspicue inaequales. Folia inferiora verticellata. Mex. aust. ..... 85. *B. amblyolepis.*

l. Pappi setae subaequales. Folia opposita vel alterna *m.*

m. Folia bene petiolata *n.*

n. Involucri squamae bene imbricatae. Capitula saepius 28–35-flora. Frutices et herbae perennes *o.*

o. Folia tenuia tomentella vel saepius glabriuscula. Neo-Mex. et Ariz. ..... 86. *B. Fendleri.*

o. Folia crassiora subcoriacea plerumque tomentosa. Mex. cent. et aust. *p.*
p. Involucri squamae extímae ovato-lanceolatae acutiusculae. (In hoc loco quaereri possit .....56. *B. Parryi.*)
p. Involucri squamae extimae late ovales apice rotundatae. (Hic quaereri possit .....57. *B. tomentella.*)
n. Involucri squamae laxius imbricatae. Capitula 40–60-flora. Herbae perennes radice tuberiformi vel paullo incrassato et lignescente *q.*
q. Involucri squamae ca. 25 tenues oblanceolatae acuminatae purpureae vel subscariosae. Caulis apicem versus saepissime nudiusculus .....87. *B. hymenochlaena.*
q. Involucri squamae ca. 60 lanceolati-lineares firmiusculae .....88. *B. simplex.*
m. Folia sessilia vel subsessilia coriacea *r.*
r. Folia vel omnia vel pleraque alterna. Calif. aust. et infer. *s.*
s. Achaenia 4 mm. longa solis in costis hispidulis. Folia viridia .....75. *B. arguta.*
s. Achaenia 1 cm. longa sericea. Folia niveo-tomentella .....89. *B. incana.*
r. Folia opposita. Mex. cent. .....90. *B. lanata.*

72. **B. chenopodina** (Greene), comb. nov.

Suffruticosa; caulibus molliter lignescentibus medullosis elongatis ut videtur procumbentibus a cortice fibrosa tectis; ramis pluribus curvato-adscendentibus foliosis apice corymbiferis; foliis alternis paullo succulentis ovatis irregulariter serratis acutis basi integris abrupte angustatis 2.5–6 cm. longis 12–23 mm. latis viridibus concoloribus subglabris, supremis lanceolatis integriusculis, petiolo 7 mm. longo; corymbis laxis paucicapitulatis; pedicellis valde (usque ad 6 cm.) elongatis dense cum glandulis stipitatis obsitis; capitulis ca. 28-floris 12 mm. altis 6 mm. diametro erectis; involucri subcylindrico-campanulati squamis extimis elongatis lanceolati-linearibus foliaceis glandulari-puberulis attenuatis valde inaequalibus flosculos saepe multo superantibus, squamis interioribus tenuibus oblongo-linearibus apice rotundatis 3–4-nerviis saepe purpurascentibus; corollis ut videtur albidis vel roseo-tinctis 7 mm. longis graciliter tubulatis; achaeniis 3 mm. longis sursum villosis; pappi setis ca. 37 tenuiter capillaribus albis minutissime barbellatis. (Fig. 76.)

Fig. 76. B. chenopodina.

Coleosanthus chenopodinus Greene ex Wooton & Standley, Contrib. U. S. Nat. Herb. xvi. 177 (1913).

NEO-MEXICO: in alluviis fluminis Gilae prope Cliff, Grant com., alt. 1372 m., *Metcalfe*, n. 776 (hbb. Gray., Mo., N. Y., U. S.).

NOTA. — Species verisimiliter distincta, infeliciter tamen a specimine ut videtur vix normali descripta. Idem (si juste judico) quoad caulem principalem a luto in alluviis per inundationem obtecta erat. Qua de causa axes secundarii numerosi a principali lateraliter orti fortasse non omnino normales sunt et cum illis plantae normaliter evolutae male quadrarent. An forma speciei praecedentis ?

73. B. GREENEI Gray, Proc. Am. Acad. xii. 58 (1877)

Herbacea erecta superne ramosa viscida 3–4.5 dm. alta; caule viridi vel brunnescente flexuoso patenter viscido-pubescente; foliis ovatis alternis plerisque obtusis 3-nerviis brevissime petiolatis utrinque viridibus pubescentibus 1.5–3 cm. longis 1–2 cm. latis irregulariter serrato-dentatis; capitulis ramos foliosos terminantibus subcorymbosis ca. 60-floris 2.2 cm. altis ca. 13 mm. diametro erectis; involucri squamis ca. 40, interioribus linearibus attenuatis substramineis, extimis magnis ellipticis herbaceis apice rotundatis vel obtusis dorso glanduloso-puberulis; corollis ut videtur ochroleucis 1 cm. longis; achaeniis subglabris solum microscopice in angulis apicem versus paullo hispidulis 7 mm. longis; pappi setis ca. 30 fere laevibus sordide albis. — Species ad Civ. Foed. bor.-occ. restricta, per involucrum exterius valde evolutum facile recognoscenda. (FIG. 77.)

FIG. 77. B. Greenei.

Gray, Syn. Fl. i. pt. 2, 104 (1884).
Coleosanthus Greenei (Gray) Ktze. Rev. Gen. i. 328 (1891).

CALIFORNIA BOR.: in monte Yolo Bola, *Brandegee* (hb. Univ. Calif.); ad locum Deer Park nominatum, Placer com., *H. D. Geis*, n. 204 (hbb. Gray., Univ. Calif.); in culmine Lassens, *Austin*, n. 375 (hb. Mo.); secundum ramum australem fluminis Scott, Siskiyou com., *Greene*, n. 1012 (hbb. Gray., Mo.); ad Grizzly Hill, *Leiberg*, n. 5103 (hb. U. S.).

OREGON: ad Waldo, *Howell*, nn. 739 (hb. Gray.), 1168 (hb. Mo.), sine numero (hbb. J. D. Sm., Univ. Calif., N. Y., Columb. Univ., U. S.); in sabulis fluminis Illinois, *Cusick*, n. 2935 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.).

74. B. ATRACTYLOIDES Gray, Proc. Am. Acad. vii. 290 (1870)

Fruticosa ramosissima; caulibus griseis a cortice ad maturitatem fisso tectis flexuosis rigidis; ramis ramulisque adscendentibus foliosis; foliis plerisque alternis ovatis rigide coriaceis acuminatis subsessilibus argute paucidentatis utrinque viridibus reticulato-venosis; capitulis ca. 50-floris 13–16 mm. altis 10–13 mm. diametro, si numerosis plus minusve corymbose dispositis; involucri campanulati squamis ca. 30, exterioribus interiores longitudine subaequantibus, extimis ovato vel lanceolato-oblongis acuminatis multistriatis; receptaculo glabro; corollis albidis vel flavidulis 7 mm. longis; achaeniis fuscescentibus in angulis sursum hispidulis 4 mm. longis; pappi setis ca. 20 sublaevibus albis. (FIG. 78.)

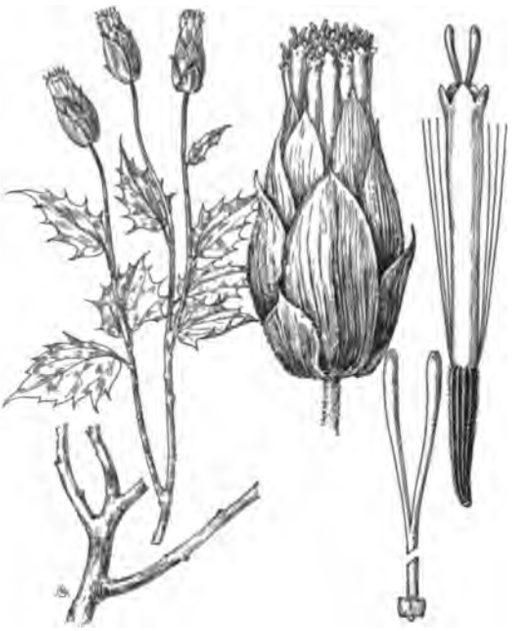

FIG. 78. B. atractyloides.

Gray, Syn. Fl. i. pt. 2, 104 (1884); D. C. Eaton in Wats. Bot. King Exped. 138 (1871); Nels. Man. Bot. Rky. Mts. 487 (1909) excl. pl. calif.

Coleosanthus atractylodes [Gray] Ktze. Rev. Gen. i. 328 (1891).

C. atractyloides (Gray) Ktze. ex Hellero, Cat. N. A. Pl. 135 (1898).

C. venulosus Nels. Bot. Gaz. xxxvii. 262 (1904).

UTAH AUST.: *Palmer* (anno 1870), sine numero (hbb. Gray., Columb. Univ., U. S.); in valle fluminis Virgen ad St. George, *Parry*, n. 90 (hbb. Gray., Mo., J. D. Sm., Brown Univ., N. Y., Phil., Jns.), *Palmer* (anno 1875), sine numero (hb. Gray.), *Palmer* (anno 1877), n. 191 (hbb. Gray., Mo., Columb. Univ., U. S.), *Jones*, n. 5110s (hb. Jns.), *Goodding*, n. 803 (hbb. Univ. Calif., Jns.).

ARIZONA: faucibus giganteis "Grand Cañon" anglice dictis, *Gray*, sine numero (hb. Gray.); ad ostia rivuli anglice Bright Angel nominati, *E. W. Nelson*, n. 124 (hb. U. S.); ad Peach Spring, *Jones* (hb. Jns.); ad Hackberry, *Jones* (hb. Jns.); ad Kingman, *Jones* (hbb. Mo., U. S., Jns.); ad castellum Mohave, *Lemmon et ux.* (hb. Univ. Calif.); Yucca, *Jones*, n. 3917 (hbb. N. Y., U. S., Arn. Arb., Jns.); ad Chimehuevis, *Jones* (hb. Jns.); ad Congress Junction, Yavapai com., *Jones* (hb. Jns.).

NEVADA: in vallicula praerupta El Dorado dicta, *Jones* (hb. Jns.), *Davis* (hb. Mo.); in desertis Amargosa, *Jones* (hbb. Mo., Univ. Calif., U. S., Jns.); in fissuris rupium ad locum "The Pockets" anglice dictum, *Goodding*, n. 678 (hbb. Gray., Mo., N. Y., U. S.); in vallicula praerupta St. Thomas, *Jones*, n. 5069p (hbb. U. S., Jns.); ad Moapam, *Kennedy*, n. 1827 (hbb. N. Y., Phil., Arn. Arb.); basi rupium prope fontem Mesquite, *Goodding*, n. 2250 (hbb. Gray., Mo., Univ. Calif., N. Y.); rupibus siccissimis sterillimisque ad Jean et Good Springs, *K. Brandegee* (hb. Univ. Calif.); ad Good Springs, *Jones* (hb. Jns.).

75. **B. arguta,** spec. nov.

Fruticosa ramosissima rigidiuscula, habitu et characteribus multis speciei praecedenti simillima, tamen ramulis pedicellisque patenter pubescentibus, pilis plus minusve basin versus incrassatis persistentibus apice saepe glandulari-capitulatis; foliis obscuris in nervis venisque pubescentibus utrinque in faciebus cum glandulis sessilibus globularibus conspersis; involucri squamis extimis ovato-lanceolatis vel lanceolato-linearibus attenuatis hinc inde una vel duabus cum dentibus instructis; flosculis achaeniisque ut apud praecedentem. — Species notabilis primo aspectu *B. atractyloidi* simillima tamen facile diagnoscere et distributione (hucusque cognita ad Californiam et super. et infer. restricta) omnino distincta. (Fig. 79.)

Fig. 79. B. arguta.

Coleosanthus atractyloides Coville, Contrib. U. S. Nat. Herb. iv. 119 (1893); Goldman, ibid. xvi. 368 (1916); non Ktze.
Brickellia atractyloides Hall, Univ. Calif. Pub. Bot. iii. 29 (1907) et auct. quoad pl. calif. non Grayi.

CALIFORNIA AUST.: in montibus prope Agua Caliente, desertis Colorado nominatis, *Parish frat.*, nn. 1210 (hbb. Gray., J. D. Sm., Univ. Calf.), 1210B (hb. U. S.); declivitate boreali montium San Bernardino, alt. 1220–1830 m., *S. B. Parish*, n. 3710 (hbb. Gray., Univ. Calif., U. S.); in desertis Mohave ad fontes Cushenberry, *S. B. Parish*, n. 2387 (hb. Columb. Univ.); ad fonte Rabbit, *S. B. Parish*, n. 4875 (hbb. N. Y., U. S.); in montibus Ord., San Bernardino com., *Hall & Chandler*, n. 6775 (hb. Univ. Calif.); ad locum Cottonwood Springs dictum, Riverside com., *Hall*, n. 6016 (hb. Univ. Calif.); in desertis Mohave, *Parish*, n. 10,123 (hbb. Gray., Univ. Calif.) ad locum " Warren's " dictum, *T. S. Brandegee* (hb. Univ. Calif.); in montibus Providence, *T. S. Brandegee* (hb. Univ. Calif.); ad Kelso, alt. 762 m., *Jones* (hb. Jns.); Inyo com., *Rixford* (hb. Univ. Calif.), *Coville & Funston*, n. 165 (hb. U. S.), *Hall & Chandler*, n. 6930 (hb. Univ. Calif.); in montibus Inyo, *S. W. Austin*, n. 565 (hb. Univ. Calif.).

CALIFORNIA INFER.: in Cañono Cantillas, *Orcutt frat.*, n. 1101 (hbb. Gray., Mo.); ad Alamo, alt. 1128 m., *Goldman*, n. 1141 (hb. U. S.).

Var. *a.* **typica,** involucri squamis vel omnibus integris vel una vel altera sola bracteiforme evoluta et plus minusve dentata. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **odontolepis,** var. nov., involucri squamis extimis pluribus conspicue dentatis. (FIG. 79 β.)

CALIFORNIA AUST.: in desertis Colorado nominatis, *C. R. Orcutt* (anno 1889), sine numero (spec. typ. in hbb. Gray., Mo., Univ. Calif., U. S.), *Brandegee* (hb. N. Y.).

76. B. OBLONGIFOLIA Nutt. Trans. Am. Philos. Soc. ser. 2, vii. 288 (1841)

Herbacea perennis erecta saepissime multicaulis 1–5 dm. alta; caudice lignescente ramoso; caulibus albidis foliosis inferne saepius simplicibus apicem versus corymbose ramosis pubescentibus et superne glandulosis; foliis alternis sessilibus elliptico-oblongis vel saepius lanceolato-oblongis vel lineari-lanceolatis integris vel nonnunquam paucidentatis obtusis vel saepissime mediocriter acutis utrinque viridibus plus minusve glandulari-puberulis 3-nerviis 1–4 cm. longis 4–15 mm. latis; capitulis erectis 40–50-floris 15–18 mm. altis ca. 8 mm. diametro pedicellatis; involucri squamis ca. 40 laxe imbricatis, interioribus linearibus acutis vel obtusis, exterioribus gradatim brevioribus lanceolati-oblongis acuminatis 3–4-striatis viridibus; corollis 8–10 mm. longis; achaeniis brunneis vel maturitate fuscescentibus glanduloso-puberulis vel cum pilis eglandularibus dense praesertim in costis obsitis; pappi setis 20–25 laete albis breviter barbellatis vel sublaevibus. — Species per Civ. Foed. occ. praesertim sabulis glareosisque in montuosis et regionibus aridis communis et late distributa habitu fere constans sed achaeniorum indumento variabilis. (FIG. 80.)

FIG. 80. B. oblongifolia.

D. C. Eaton in Wats. Bot. King Exped. 137 (1871); Gray, Syn. Fl. i. pt. 2, 104 (1884).
Coleosanthus oblongifolius (Nutt.) Ktze. Rev. Gen. i. 328 (1891).
C. linifolius Piper & Beatie, Fl. southeast. Wash. 258 (1914), non *B. linifolia* D. C. Eaton.

MONTANA: *Tweedy*, n. 217 (hb. Columb. Univ.).
IDAHO: *Jones* (hb. Jns.); *Macbride*, n. 348 (hbb. Gray., Mo., N. Y., U. S.); *Merrill*, n. 397 (hb. U. S.); *Nelson & Macbride*, n. 1163 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); *Henderson*, nn. 3219 (hb. U. S. ad var. γ transiens), 4824 (hb. Gray.).

BRIT. COLUMBIA: secundum flumen Skagit, *J. M. Macoun*, n. 76,963 (hb. N. Y.); secundum flumen Similkameen (fortasse in Washington), *Lyall* (hb. Gray.).

WASHINGTON: *Brandegee*, nn. 74 (hb. Mo.), 156 (hbb. Gray., Mo., Univ. Calif.) forma foliis aliquid dentatis, 836 (hbb. Gray, Univ. Calif.); *Cotton*, nn. 710 (hbb. Gray., Mo., Phil., U. S.), 819 (hb. U. S.); *Elmer*, nn. 369 (hbb. Mo., Univ. Calif., N. Y., U. S.); 1376 (hb. Mo.); *Horner*, nn. 248 (hb. U. S.), R354B248 (hb. Gray.); *Howell* (hb. Gray.); *Piper*, n. 2745 (hbb. Gray., N. Y.), sine numero (hb. Gray.); *Sandberg & Leiberg*, nn. 408 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.), 491 (hbb. Gray., Univ. Calif., N. Y., U. S.), 7037 (hb. N. Y.); *Sandberg, MacDougal & Heller*, n. 911 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S.); *Tweedy* (hb. Columb. Univ.); *G. R. Vasey*, n. 541 (hbb. Gray., N. Y., U. S.); *Whited*, nn. 574 (hbb. Gray., U. S.), 690 (hb. U. S.); *Wilkes Exped.*, n. 540 (hb. U. S.).

OREGON: *Cooper* (hbb. Gray., Columb. Univ.); *Cusick*, nn. 670 (hb. J. D. Sm.), 2696 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.), sine numero (hb. Gray.); *Leiberg*, nn. 802 (hb. U. S.), 955 (hbb. Gray., Mo., Univ. Calif., N. Y.); *Nuttall* (hbb. Gray., N. Y., Phil.); *Wilkes Exped.* (hbb. Gray., Columb. Univ.).

NEVADA: *Heller*, nn. 8638 (hbb. Gray., Mo., N. Y., Phil., U. S.), 10,993 (hbb. Gray., Mo., Univ. Calif., N. Y.) ad var. *linifoliam* transiens; *Hillman* (hb. Jns.); *Jones* (hbb. Mo., U. S., Jns.); *Nelson & Macbride*, n. 2220 (hbb. Gray., Mo., U. S.).

UTAH: ad Belknap, alt. 1830 m., *Stokes* (hb. Univ. Calif.).

Var. *α*. **typica**, caulibus 2–5 dm. altis foliis saepissime 2–4 cm. longis lanceolato- vel lineari-oblongis; pilis achaeniorum vel omnes vel maxime ex parte glanduloso-capitatis (glandulis vel sessilibus vel brevissime stipitatis). — Synon. et distrib. et exsicc. ut supra dictae.

Var. *β*. **abbreviata** Gray, parva; caulibus 9–14 cm. solum altis; foliis ellipticis brevibus (9–14 mm. longis); achaeniis cum glandulis minutis sessilibus sparse obsitis aliter glabris. — Gray ex D. C. Eaton in Wats. Bot. King Exped. 137, t. 15, ff. 7–10 (1871). (Fig. 80 *β*.)

Gray, Syn. Fl. i. pt. 2, 104 (1884).
Coleosanthus abbreviatus (Gray) Greene, Pittonia, iv. 125 (1900).

NEVADA BOR.: in parte occidentali montium Humboldt, *Watson*, n. 492 (hbb. Gray., Columb. Univ., U. S.). Varietas vel potius forma nana minime valens.

Var. *γ*. **linifolia** (D. C. Eaton), comb. nov., achaeniis sursum cum pilis eglandularibus praesertim in costis dense hispidulis; glandulis sphaericis vel sessilibus vel stipitatis paucis nonnunquam interspersis; aliter var. *typicae* omnino simillima et in eam gradatim transiens. — Varietas saepius (non semper) facile recognoscenda, distributione ad aust. quam var. *α* multo ultius vergens, locos aridiores adfectans. (Fig. 80 *γ*.)

Brickellia linifolia D. C. Eaton in Wats. Bot. King Exped. 137, t. 15, ff. 1–6 (1871); Gray, Syn. Fl. i. pt. 2, 104 (1884); Hall, Univ. Calif. Pub. Bot. iii. 30 (1907); Nels. Man. Bot. Rky. Mts. 487 (1909).
B. mohavensis Gray, Syn. Fl. i. pt. 2, 104 (1884).
Coleosanthus linifolius (D. C. Eaton) Ktze. Rev Gen. i. 328 (1891); Coville, Contrib. U. S. Nat. Herb. iv. 120 (1893).

C. mohavensis (Gray) Ktze. l. c. (1891).
C. humilis Greene, Pittonia, iv. 124 (1900).
Brickellia humilis (Greene) Nels. Man. Bot. Rky. Mts. 487 (1909) in synon.

COLORADO OCC.: *Baker*, n. 657 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); *Brandegee*, n. 1178 (hbb. Univ. Calif., Mo., Columb. Univ.); *Crandall* (hb. N. Y.); *Eastwood* (hbb. Mo., Univ. Calif.); *Jones*, n. 5476h (hbb. U. S., Jns.), sine numero (hb. Jns.); *Payson*, n. 482 (hbb. Gray., Mo.); *Purpus*, n. 193 (hb. Univ. Calif.); *Stokes* (hbb. N. Y., U. S.); *Walker*, n. 123 (hbb. Gray., U. S.).

NEO-MEXICO BOR.-OCC.: ad Farmington, *Diehl* (hb. Jns.).

UTAH: *Jones*, nn. 1830 (hbb. N. Y., Columb. Univ., U. S., Arn. Arb., Jns.), 1830a (hb. Jns.), 5289o (hbb. U. S., Jns.), 5463 (hbb. Mo., Univ. Calif., N. Y., U. S., Jns.), 5663ah (hb. Jns.), 5989 (hbb. U. S., Jns.), sine numero (hbb. Mo., Univ. Calif., U. S., Arn. Arb., Jns.); *Palmer* (anno 1877), sine numero (hb. Univ. Calif.), n. 192 (hbb. Gray., Mo., N.Y., Columb. Univ.); *Parry*, n. 89 (hbb. Gray., Mo., J. D. Sm., Columb. Univ., Phil.); *Purpus*, n. 6475 (hbb. Mo., Univ. Calif., U. S.); *Rydberg & Carlton*, nn. 6954 (hbb. N. Y., U. S.), 6955 (hbb. Gray., N. Y.), 6974 (hb. N. Y.); *Rydberg & Garrett*, nn. 8535 (hb. N. Y.), 9880 (hbb. N. Y., U. S.); *Watson*, n. 493 (hbb. Gray., Columb. Univ., U. S.).

ARIZONA BOR.: ad Willow Spring, *Jones* (hb. N. Y.); ad trajectum Tanner's fluminis Colorado minoris, *Ward* (hbb. N. Y., U. S.); sine loco exactiore, *Palmer* (hb. Gray.).

NEVADA: *Goodding*, n. 908 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.) *Griffiths & Hunter*, n. 50 (hbb. N. Y., U. S.); *Heller*, n. 10,606 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); *Hillman* (hbb. Gray., Jns.); *Jones* (hb. Jns.); *Lemmon*, nn. 21 (hb. Mo.), 29 (hb. Mo.); *Purpus*, n. 5951 (hbb. Univ. Calif., N. Y., U. S.); *Searles* (hb. Gray.).

CALIFORNIA AUST.-OR.: *S. W. Austin*, n. 217 (hb. Univ. Calif.); *K. Brandegee* (hb. Univ. Calif.); *Coville & Funston*, n. 943 (hbb. Columb. Univ., U. S.); *Davidson*, n. 2761 (hb. Univ. Calif.) forma foliis nonnullis dentatis; *Hall*, nn. 1888 (hb. Univ. Calif.), 2142 (hbb. Mo., Univ. Calif., N. Y., U. S.); *Lemmon*, n. 3323 (hb. Gray.); *Palmer* (anno 1876, n. 168 (hbb. Gray., Mo., Univ. Calif., Columb. Univ., Phil., U. S.); *Parish frat.*, nn. 1247 (hbb. Gray., J. D. Sm., U. S.), 1247* (hb. N. Y.); *S. B. Parish*, nn. 3181 (hbb. Mo., N. Y., U. S.), 3711 (hbb. Gray., Univ. Calif., U. S.), sine numero (hbb. Univ. Calif., Jns.); *Purpus*, nn. 1920 (hb. Univ. Calif.), 5356 (hbb. Gray., Mo., Univ. Calif., U. S.).

FIG. 81. B. Wisliseni.

77. B. WISLIZENI Gray, Pl. Fendl. 64 (1849)

Herbacea 2.5–6 dm. vel ultra alta glanduloso-pubescens paullo scabrida; caulibus saepius pluribus e caudice lignescente suberectis foliosis inferne simplicibus

superne racemose vel corymbose ramosis; foliis oppositis sessilibus vel subsessilibus ovato-oblongis serratis acutis vel obtusis basi cordatis vel saepius rotundatis utrinque pubescentibus reticulatis 3–5.5 cm. longis 1.5–3.5 cm. latis; capitulis ca. 50–60-floris 15 mm. altis 13 mm. diametro; involucri campanulati squamis lanceolato-linearibus plus minusve pubescentibus laxe imbricatis attenuatis 5–6-striatis, extimis quam interiores vix dimidio brevioribus; corollis ochroleucis ca. 1 cm. longis; achaeniis ca. 4 mm. longis brunneis sericeis; pappi setis ca. 45 albis barbellatis. (FIG. 81.)

Gray, Pl. Wright. i. 84 (1852) excl. pl. Seemannii, sed non Pl. Wright. ii 71 (1853) nec Syn. Fl. i. pt. 2, 107 (1884) quoad pl. arizonicam.

Brickellia Wislizeni, var. *brevifolia* Gray ex Pringleo, Pl. Mex. 1885, nunquam descripta, non differt.

Coleosanthus Wislizenii [Gray] Ktze. Rev. Gen. i. 328 (1891).

C. Wislizeni (Gray) Ktze. ex Hellero, Cat. N. A. Pl. 135 (1898) quoad syn. nominiferum.

MEXICO BOR.: CHIHUAHUA: in montuosis a Cosiquiriachi ad occ. spect., *Wislizenus*, n. 188 (hbb. Gray., Mo.); in collibus petrosis prope urbem Chihuahuam, *Pringle*, n. 323 (hbb. Gray., J. D. Sm., N. Y., Phil., U. S.); in montibus Mapula, *Pringle*, n. 925 (hbb. Mo., Univ. Calif.); collibus prope Parral, *Goldman*, n. 113 (hbb. Gray., N. Y., U. S.), *E. W. Nelson*, n. 5008 (hbb. Gray., U. S.), *Pringle*, n. 13,542 (hbb. Gray., U. S.). DURANGO: *Palmer* (anno 1896), nn. 281 (hbb. Gray., Univ. Calif., U. S.), 505 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); ad Tejamén, *Palmer* (anno 1906), n. 518 (hbb. Gray., Mo., Field Mus., N. Y., U. S.).

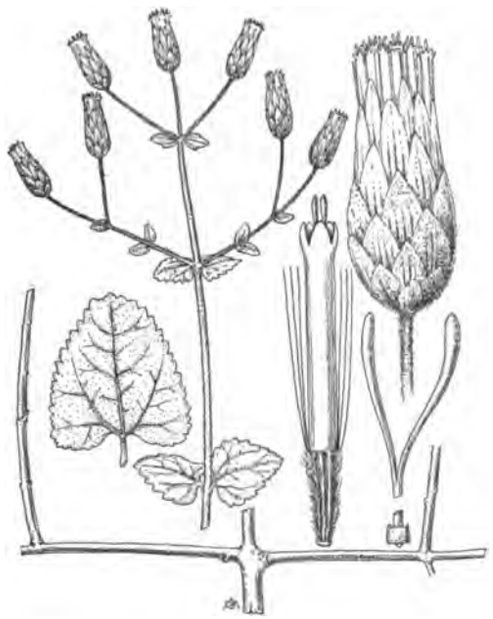

FIG. 82. B. Brandegei.

78. **B. Brandegei,** spec. nov.

Fruticosa divaricatim oppositiramea dense glanduloso-puberula; caulibus teretibus brunneis; ramis ramulisque foliosis; foliis oppositis late ovatis crenato-dentatis subcoriaceis utrinque breviter griseo-pubescentibus 1.4–2.5 cm. longis 1.2–2.3 cm. latis apice rotundatis basi late cordatis a basi 3-nerviis subtus reticulatis, petiolo 3–4 mm. longo; panicula terminali patenter oppositiramea paucicapitulata; capitulis ca. 28-floris ca. 1 cm. altis 6 mm. diametro; pedicellis 1.2–2.2 cm. longis juventate apicem versus nutantibus vel uncinatis maturitate plerumque rectis; involucri campanulati squamis pluriseriatim imbricatis acutis ca. 4-striatis,

interioribus anguste oblongis, exterioribus ovato-oblongis vel ovatis; receptaculo glabro; corollis 7 mm. longis ochroleucis graciliter tubulatis; achaeniis ca. 3 mm. longis fusco-griseis hirsutulis; pappi setis albis sublaevibus. — Species *B. peninsulari* aliquid similis sed ramis divaricatis, foliis et capitulis multo minoribus, petiolis pedicellisque multo brevioribus facile distinguenda. Exploratorum botanicorum Californiae inferioris principi clarissimo reverenter dedicata. (FIG. 82.)

CALIFORNIA INFER.: ad La Paz, 14 Apr. 1892, *T. S. Brandegee* (hb. Univ. Calif., phot. in hb. Gray.).

79. **B. macromera,** spec. nov.

Fruticosa; caulibus ut videtur erecta ad 6 dm. vel ultra altitudine albis dense crispeque hirtellis medullosis; internodiis longissimis (ad 13 cm. longitudine), cortice aetate longitudinaliter fisso; ramis paucis oppositis late patentibus; foliis oppositis vel subopppositis breviter petiolatis reniformi-ovatis cordatis apice rotundatis margine crenato-serratis subconcoloribus utrinque obscuris griseo-pubescentibus subtus minute punctatis 1.5–3 cm. longis 2–4 cm. latis; capitulis paucis in apicibus caulium subumbellatim cymosis ca. 47-floris ca. 1.5 cm. altis; involucri squamis tenuibus 4–6-striatis, extimis ovato-oblongis acutis viridibus, intermediis et intimis oblongis subdiaphanis roseo-tinctis apice rotundatis; corollis albidis gracillimis 8–9 mm. longis; achaeniis rufo-brunneis sursum griseo-pubescentibus 3.6 mm. longis; pappi setis ca. 30 delicatule capillaribus simplicibus. — Species praecedenti arcte affinis, sed magnitudine partium et squamis obtusissimis facile distinguenda. Nomen ad internodia praeter modum elongata alludit. (FIG. 83.)

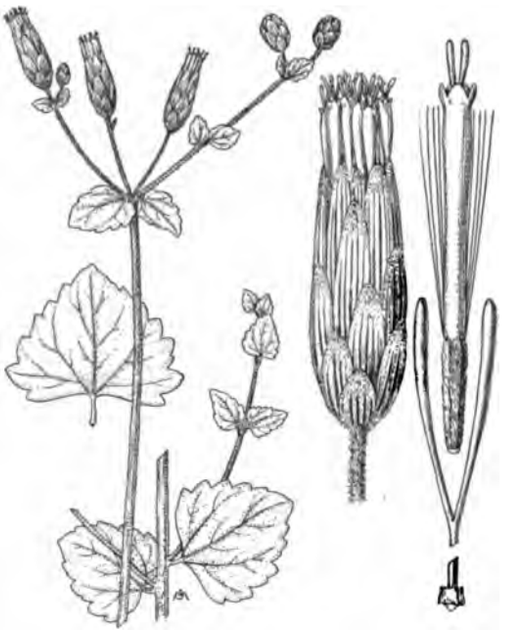

FIG. 83. B. macromera.

CALIFORNIA INFER.: ad apicem sinus Conceptionis, 6 Apr. 1911, *Dr. J. N. Rose,* n. 16,693 (hbb. U. S., N. Y., phot. in hb. Gray.).

NOTA. — Hanc species primi cll. Dr. J. N. Rose et P. C. Standley in herbariis (sub *Coleosantho*) discriminaverunt, sed eae infeliciter nomen dedunt quod sub *Brickellia* ob homonymiam cum nomine jam usum et adhuc validum uti non possum.

80. B. PENINSULARIS Brandegee, Zoe, v. 160 (1903)

Frutescens superne ramosa scabriuscula ad 2.5 m. alta; caulibus teretibus albidis glanduloso-pubescentibus foliosis; foliis oppositis ovatis vel ovato-oblongis obtusis crenato-serratis utrinque viridibus glandulari-atomiferis supra hirtellis subtus paullo pallidioribus pubescentibus vel tomentosis 3–8 cm. longis 2–4.5 cm. latis tenuibus basi plerumque truncatis vel cordatis rarius aliquid angustatis, petiolo 1–2.5 cm. longo; capitulis ca. 30-floris 14 mm. altis 9 mm. diametro longe pedicellatis corymbose paniculatis; involucri squamis ca. 24, interioribus lanceolati-linearibus acutis subglabris, exterioribus plusquam dimidio brevioribus 4–7-striatis saepe subherbaceis oblongo-lanceolatis acuminatis glanduloso-puberulis saepe apicem versus squarroso-recurvatis; corollis ca. 8 mm. longis; achaeniis 4.5 mm. longis griseo-sericeis; pappi setis ca. 50 albis minute barbellatis. (FIG. 84.)

FIG. 84. B. peninsularis.

CALIFORNIA INFER.: prope San José del Cabo, *Brandegee* (hbb. Univ. Calif., N. Y.), *Purpus*, nn. 485 (hbb. Mo., U. S.), 7276 (hbb. Gray., Univ. Calif.), 7276b (hb. Univ. Calif.); ad Miraflores, *Brandegee* (hb. Univ. Calif.); Sierra de la Laguna, *Brandegee* (hb. Univ. Calif.); sine loco exactiore, *Xantus* (hb. Gray.).

INSULA SOCORRO: *Barkelew*, n. 198 (hbb. Gray., Mo., Univ. Wyo., N. Y., Arn. Arb.) forma paullo compactior.

81. B. CARDIOPHYLLA Robinson, Proc. Am. Acad. xxxvi. 485 (1901)

Gladuloso-puberula 6–15 dm. alta; caulibus pallide griseis vix lignescentibus medullosis oppositirameis; foliis oppositis

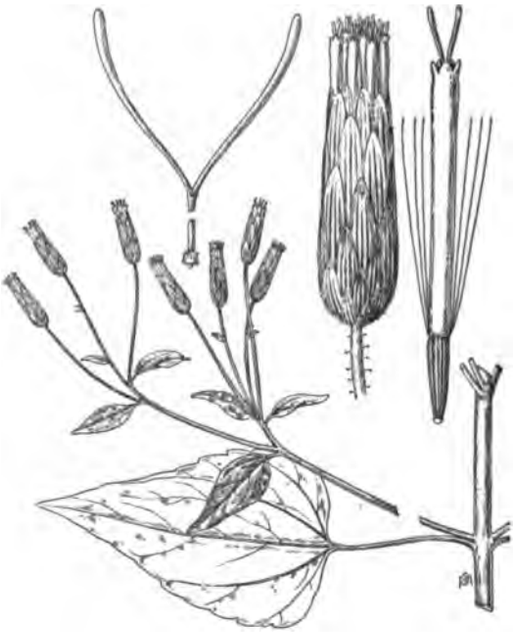

FIG. 85. B. cardiophylla.

Brickellia magnifolia M.E. Jones
- habitus 1.2 - 2.4 m tall
leaves subdeltoid - ovate, narrowly
acuminate at tip 7-9 cm long,
5-7 cm wide.
petioles 2 - 3.5 cm long
heads 10-12-flowered, ca 9 mm long,
4 mm wide
involucral bracts many, each
corolla 5.5 mm long;
achenes 3.5 mm long, brown
to grayish-white.
Type

isve grosse crena-
nuibus subglabris
petiolo 1–6 cm.
m. diametro laxe
i squamis ca. 45
is; corollis ochro-
appi setis paucis

ice dicta prope Gua-
. Calif., N. Y., Phil.,

90)

pallide brunneis;
late rhomboideo-

omboidea.

n. 323 (hbb. Gray.,
), n. 322 (hbb. Gray.,

83. B. CORDIFOLIA Ell. Sk. ii. 290 (1822–4)

Herbacea erecta 5–12 dm. alta tenuiter pubescens; caulibus striatis saepe purpureo-maculatis foliosis infra simplicibus ad apicem corymbiferis; foliis oppositis deltoideo-ovatis late cordatis saepius attenuatis grosse serratis tenuibus supra viridibus in costis paullo hirtellis subtus distincte pallidioribus molliter pubescentibus glandulari-atomiferis 6–8 cm. longis 3–5 cm. latis, petiolo 1–4 cm. longo gracili; capitulis ca. 45-floris 14 mm. altis ca. 11 mm. diametro pedicellatis in corymbos planiusculos terminales dispositis; involucri squamis ca. 35 laxe imbricatis, interioribus anguste oblongis obtusiusculis ca. 4-striatis apicem versus saepius tomentosis, extimis lineari-filiformibus flexuosis herbaceis; corollis laete purpureis spectabilibus 6.5 mm. longis sursum distincte ampliatis; achaeniis 5.2 mm. longis gracillimis brunnescentibus in costis sursum tenuiter hispidulis aliter glabris; pappi setis ca. 40 purpurascenti-fulvis distincte barbellatis. — Species rara distributione (Civ. Foed. aust.-or.) restricta ab congeneribus geographice remota, mesophytica terras pingues adfectans. (FIG. 87.)

FIG. 87. B. cordifolia.

Gray, Syn. Fl. i. pt. 2, 105 (1884).
Coleosanthus cordifolius (Ell.) Ktze. Rev. Gen. i. 328 (1891); Small, Fl. S. E. U. S. 1178 (1803).

GEORGIA OCC.: *Boykin* (hb. Gray.); ad Cuthbert, *Harper*, n. 1743 (hbb. Mo., N. Y., U. S.).
ALABAMA AUST.-OR.: in collibus silvestribus, *Buckley* (hb. Gray.); ad Auburn, Lee com., *Earle & Baker*, nn. 772 (hb. Columb. Univ.), 857 (hb. Columb. Univ.), 957 (hbb. Mo., N. Y.), *Lloyd & Earle* (hb. N. Y.); sine loco exactiore, *E. A. Smith* (hb. J. D. Sm.).
FLORIDA: sine loco exactiore, *Chapman* (hb. Mo.), *Berg* (hb. N. Y.); in parte media civitatis, *Chapman*, n. 266 (hb. Columb. Univ.); in umbrosis pinetorum prope Marianam, *Rugel* (hbb. Mo., Columb. Univ., U. S.); Jackson com., *Curtiss*, n. 1188 (hbb. J. D. Sm., U. S.); ad Bellair, Leon com., *Nash*, n. 2554 (hbb. Gray., Mo., Columb. Univ., Phil., U. S.).

84. B. GRANDIFLORA (Hook.) Nutt. Trans. Am. Philos. Soc. ser. 2, vii. 287 (1841)

Herbacea 3–7 dm. alta; radicibus longis fusiforme incrassatis; caulibus juventate cinerascenti-tomentellis foliosis superne ramosis; foliis plerisque alternis

deltoideo-ovatis vel -lanceolatis serratis vel crenatis acutis vel plus minusve acuminatis tenuibus utrinque viridibus inconspicue hirtellis 3-nerviis basi vel cordatis vel subtruncatis saepe ad insertionem petioli breviter cuneatis 3–11 cm. longis, petiolo 1–7 cm. longo; capitulis 20–38-floris 12–14 mm. diametro ad apices ramorum subumbellatim corymbosis conjunctim paniculam laxam saepius formantibus erectis vel saepius nutantibus; pedicellis filiformibus flexuosis brevibus vel usque ad 3 cm. longis; involucri squamis ca. 30 viridibus 5–7-striatis laxe imbricatis, interioribus oblanceolato-linearibus acutis, extimis ovato-oblongis vel lanceolatis cum appendice longa filiformi herbacea laxe flexuosa munitis; flosculis viridi- vel flavidi-albis cum styli ramis aureo-flavis conspicue exsertis; achaeniis 5 mm. longis brunneo-fuscis hirtellis; pappi setis 19–26 albis barbellatis caducis. — Species omnium vulgatissima per regionem latissimam Am. Bor. occ. distributa, habitu et characteribus nonnullis aliquid variabilis, nunc stricte mesophytica luxurians viridis glabriuscula statura grandior foliis magnis tenuibus nunc paullo magis xerophytica in locos sicciores et in montuosa aperta aridiora errans et qua de causa statura humilior cum foliis minoribus paullulo crassioribus pallidioribus majus puberulis, tamen si ab speciminibus copiosis caute scrutata vix in varietates satis facientes dividenda. (FIG. 88.)

FIG. 88. B. grandiflora.

Gray, Pl. Wright. i. 85 (1852), ii. 73 (1853), Bot. Calif. i. 300 (1876), Syn. Fl. i. pt. 2, 105 (1884); D. C. Eaton in Wats. Bot. King Exped. 138 (1871); Nels. Man. Bot. Rky. Mts. 486 (1909).
Eupatorium ? grandiflorum Hook. Fl. Bor.-Am. ii. 26 (1834).
Brickellia grandiflora, var. *minor* Gray, Proc. Acad. Philad. 1863, 67 (1863), & Syn. Fl. i. pt. 2, 105 (1884); Nels. Man. Bot. Rky. Mts. 486 (1909).
Coleosanthus grandiflorus (Hook.) Ktze. Rev. Gen. i. 328 (1891); Britton & Brown, Ill. Fl. iii. 314, f. 3633 (1898); Rydb. Fl Colo. 336 (1906); Piper & Beattie, Fl. S. E. Wash. 258 (1914).
C. gracilipes Greene, Pittonia, iv. 237 (1901).
C. populifolius Greene, l. c. 238 (1901).
C. umbellatus Greene, l. c. (1901); Rydb. Fl. Colo. 336 (1906).
C. congestus Nels. Bot. Gaz. xxxi. 401 (1901).
C. Garrettii Nels. Proc. Biol. Soc. Wash. xx. 38 (1907).
Brickellia ambigens Nels. Man. Bot. Rky. Mts. 486 (1909) quoad pll. coloradens. et utahens.
B. umbellata (Greene) Nels. l. c. (1909).
Coleosanthus minor (Gray) Daniels, Fl. Boulder, 225 (1911).

MISSOURI: collibus saxosis etc., *Bush*, nn. 106 (hbb. Mo., N. Y., U. S.), 168 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.), 1122 (hbb. Gray., Mo., N. Y., U. S.), 3507 (hbb. Gray., Mo., N. Y., U. S.), 4861 (hbb. Gray., Mo.), 5361 (hb. Mo.); *Eggert* (hbb. Gray., Mo., Univ. Calif.); *Letterman* (hb. Mo.); *Norton* (hb. Mo.); *E. J. Palmer*, nn. 4523 (hb. Mo.), 4713 (hb. Mo.); *Trelease*, n. 591 (hb. Mo.).

ARKANSAS: in silvis pinguibus collinis ad Beaver, Carroll com., *E. J. Palmer*, n. 4488 (hb. Mo.); in ripis fluminis White ad Cotter, Baxter com., *E. J. Palmer*, n. 4731 (hb. Mo.).

NEBRASKA: *H. M. Baker* (hb. Mo.); *Bates*, n. 3002 (hb. Gray.); *Rydberg*, nn. 137 (hb. U. S.), 187 (hbb. N. Y., U. S.).

COLORADO: *Baker*, nn. 656 (hbb. Gray., Mo., N. Y., U. S.), 680 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.); *Brandegee*, n. 508 (hbb. Mo., Univ. Calif., N. Y.), sine numero (hb. Mo.); *S. L. Clarke*, n. 212 (hb. N. Y.); *F. E. & E. S. Clements*, n. 118 (hbb. Gray., Mo., N. Y., U. S.); *Cowen* (hb. N. Y.); *Crandall*, nn. 2782 (hb. N. Y.), 2786 (hbb. N. Y., U. S.); *Crandall & Cowen*, n. 230 (hb. U. S.); *Eccles* (hb. Columb. Univ.); *Eggleston*, n. 6107 (hb. U. S.); *Engelmann* (hb. Mo.); *Glatfelter* (hb. Mo.); *Goodding*, nn. 1786 (hbb. N. Y., U. S.), 1919 (hbb. Gray., Mo., Univ. Calif., N. Y., Phil., U. S.); *Hall & Harbour*, n. 313 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.); *Johnston* n. 715 (hb. Mo.); *Jones*, n. 685 (hb. Jns.); *Kuntze*, n. 3060 (hb. N. Y.); *Letterman* (hbb. Gray., Mo.); *Meehan* (hb. U. S.); *Mulford* (hbb. Mo., Columb. Univ.); *Osterhout*, n. 2414 (hbb. Univ. Calif., N. Y., Phil.); *Pace* (hb. Mo.); *Parry* (anno 1861) sine numero (hb. Gray.), (anno 1862), n. 423 (hbb. Gray., Mo., U. S.), (anno 1872) sine numero (hbb. Mo., J. D. Sm., N. Y., Columb. Univ.); *Patterson*, n. 221 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Columb. Univ.); *Popenoe* (hb. Mo.); *Purpus*, n. 347 (hb. Univ. Calif.); *Rydberg* (hb. N. Y.); *Shear*, nn. 3264 (hb. N. Y.), 3776 (hbb. N. Y., U. S.); *Shear & Bessey*, n. 3929 (hbb. N. Y., U. S.); *Sheldon*, nn. 51 (hb. U. S.), 455 (hb. U. S.); *B. H. Smith* (hb. Phil.); *H. G. Smith, Jr.* (hb. W. Deanei); *Tracy & Evans*, n. 858 (hb. N. Y.); *Tweedy*, nn. 322 (hb. U. S.), 4023 (hbb. N. Y., U. S.), 4942 (hb. N. Y.); *Underwood & Selby*, n. 14 (hb. N. Y.); *G. R. Vasey*, n. 322 (hb. Mo.); *Walker*, n. 445 (hb. Gray.); *Ward* (hb. U. S.); *Wolf*, nn. 422 (hb. U. S.), 423 (hb. N. Y.); *Wolf & Rothrock*, nn. 422 (hb. Phil.), 423 (hb. Phil.).

WYOMING: *Frémont* (hbb. Gray., Columb. Univ.); *A. Nelson*, nn. 423 (hb. Gray.), 1687 (hbb. Gray., Mo., Columb. Univ., U. S.), 4212 (hbb. Gray., Mo., N. Y.), 7506 (hbb. Gray., Mo., N. Y., U. S.), 8766 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.); *A. & E. Nelson*, n. 6420 (hbb. Mo., N. Y.); *Schuchort* (hb. U. S.); *Tweedy*, n. 517 (hbb. N. Y., U. S.).

MONTANA: *Anderson*, n. 190 (hb. Univ. Calif.); *E. N. Brandegee* (hb. Univ. Calif.); *Flodman*, n. 816 (hbb. N. Y., U. S.); *Jones* (hb. Jns.); *Lamson-Scribner*, n. 71 (hb. Phil.); *Rose*, n. 249 (hb. U. S.); *Scheuber*, n. 37 (hb. N. Y.); *Watson*, n. 178 (hb. Gray.); *Williams*, n. 223 (hb. U. S.).

IDAHO: *Henderson*, n. 3656 (hb. U. S.); *Sandberg*, n. 4292 (hb. N. Y.); *Sandberg, MacDougal & Heller*, n. 749 (hbb. Gray., J. D. Sm., N. Y., U. S.); *Watson*, n. 178 (hbb. Gray., U. S.).

WASHINGTON: *Brandegee*, n. 835 (hbb. J. D. Sm., Univ. Calif., Phil.); *Douglas* (spec. typ.); *Geyer*, n. 452 (hbb. Gray., N. Y.); *Horner*, nn. 247 (hb. U. S.), R351B247 (hb. Gray.); *Kreager*, nn. 542 (hbb. Gray., N. Y., U. S.), 547 (hbb. Gray., N. Y., U. S.); *Piper*, n. 2381 (hb. Gray.); *Savage, Cameron & Lenocker*, n. 7 (hb. Mo.); *Umbach*, n. 486 (hb. N. Y.)

OREGON: *Brown*, n. 45 (hb. U. S.), sine numero (hbb. Mo., N. Y., Phil.); *Cusick*, n. 2102 (hbb. Gray., Mo., Univ. Calif., U. S.); *C. Davidson* (hb. Mo.); *Howell* (hb. J. D. Sm.).

UTAH: *Clemens* (hb. Jns.); *Dodge* (hb. Columb. Univ.); *Garrett*, nn. 1061 (hb. Univ. Wyo.), 1590 (hb. Gray.), 1590a (hb. N. Y.); *A. E. Hitchcock*, n. 1470 (hb. U. S.); *Jones*, nn. 1269 (hbb. Columb. Univ., U. S., Jns.), 5992 (hbb. Mo., Univ. Calif., N. Y., U. S., Jns.), sine numero (hb. Jns.); *Rydberg & Carlton*, n. 7575 (hb. N. Y.); *Rydberg & Garret*, nn. 9612 (hb. N. Y.), 9689 (hbb.

Univ. Calif., N. Y., U. S.); *Tracy & Evans*, n. 707 (hb. N. Y.); *Watson*, n. 496 (hbb. Gray., Columb. Univ., U. S.).

NEO-MEXICO: *Bigelow* (hbb. Columb. Univ., U. S.); *Blumer*, n. 20 (hbb. Gray., N. Y., U. S.); *Cockerell* (hb. N. Y.); *Coghill*, nn. 138 (hb. Mo.), 162 (hb. Mo.); *Diehl*, n. 420 (hb. Jns.); *F. S. & E. S. Earle*, n. 502 (hbb. Mo., N. Y., U. S.); *Ellis*, n. 226 (hb. Mo.); *Fendler*, nn. 306 (hbb. Gray., Mo.), 335 (hbb. Gray., Mo.); *Goldman*, n. 1687 (hb. U. S.); *Griffiths*, n. 5499 (hb. U. S.); *Holway*, n. 5003 (hb. Gray.); *Metcalfe*, n. 1381 pro parte (hbb. Gray., U. S., Jns.); *F. G. Plummer* (hb. U. S.); *Rusby*, n. 237 (hbb. Mo., J. D. Sm., Univ. Calif., U. S.); *Standley*, nn. 7692 (hb. U. S.), 8232 (hb. U. S.); *Standley & Bollman*, nn. 10,666 (hb. U. S.), 11,066 (hb. U. S.); *G. R. Vasey* (hb. J. D. Sm.); *Wooton*, nn. 124 (hb. U. S.), 340 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.), 490 (hbb. N. Y., U. S., Jns.), sine numero (hb. U. S.); *Wooton & Standley*, n. 3646 (hb. U. S.), sine numero (hb. U. S.); *Wright*, n. 1143 (hbb. Gray., Mo., Columb. Univ., Phil., U. S.).

ARIZONA: *Blumer*, nn. 2244 (hb. U. S.), 3355 pro parte (hb. Gray.); *Eggleston*, n. 10,856 (hb. U. S.); *Griffiths & Thornber*, n. 101 (hb. U. S.); *Jones*, n. 4091 (hbb. U. S., Jns.), sine numero (hb. Jns.); *Knowlton*, n. 7 (hb. U. S.); *Leiberg*, n. 5801 (hb. U. S.); *MacDougal*, n. 365 pro parte (hb. Gray.); *Mearns*, nn. 2594 (hb. U. S.), 2611 (hb. U. S.); *Nealley*, n. 199 (hb. U. S.); *Rusby* (hb. N. Y.); *Toumey*, n. 4 (hb. Univ. Calif.)

CALIFORNIA: *Austin*, n. 383 (hbb. Mo., Univ. Calif.); *M. S. Baker* (hb. Univ. Calif.); *Bolander*, n. 5030 (hbb. Gray., Mo., Univ. Calif., U. S.); *Bridges*, n. 246 (hbb. Columb. Univ., U. S.); *C. C. Bruce*, n. 383 (hb. U. S.); *Butler*, n. 305 (hb. Univ. Calif.); *Carpenter* (hb. Univ. Calif.); *Hall*, n. 8802 (hb. Univ. Calif.); *Lemmon*, nn. 39 (hb. Mo.), 87 (hb. Gray.), 1101 (hb. Gray.).

NOTA. — Hujus speciei formae nonullae ab inflorescentia laxiore vel densiuscula, margine foliorum crenata vel argutius dentata ut dicitur distinguendae et pro speciebus distinctis ab auctoribus saepe propositae sunt; sed hae omnes (speciminibus permultis examinatis) inter se copiose intergradiunt et nullo modo etiam pro varietatibus recognoscendae sunt. Vix distinguendae sunt sequentes: Var. α. **typica**, uberior mesophytica 5–7 dm. alta, foliis majoribus plerisque 5–11 cm. longis tenuibus inconspicue hirtellis. — In civitat. seq. frequentior: Missouri, Nebraska, Montana, Idaho, Washington, Oregon, California, Neo-Mexico. Var. β. MINOR Gray (Proc. Acad. Philad. 1863, p. 67, & Syn. Fl. i. pt. 2, 105), humilior compactior paullo xerophytica 3–5 dm. alta brevissime densius puberula; foliis plerisque minoribus paullo firmiusculis. — In civitat. Colorado et Arizona praevalens. Paullo melius distinguenda est:

Var. γ. PETIOLARIS Gray, gracilis 4–10 dm. alta; foliis firmiusculis minute scabrido-puberulis subhastato-deltoideis caudato-acuminatis; petiolis plerisque saltem laminam dimidio aequantibus vel foliorum inferiorum eam vere superantibus; axillis saepissime proliferis. — Proc. Am. Acad. xvii. 207 (1882), & Syn. Fl. i. pt. 2, 105 (1884). (FIG. 88 γ.)

Coleosanthus petiolaris (Gray) Greene, Bull. Torr. Bot. Club, xxv. 117 (1898).

COLORADO: ad urbem Cañon dictam, *Clements*, n. 275 (hb. N. Y.).

NEO-MEXICO: in montibus Organ nominatis, Dona Ana com., *Wooton* (hbb. Univ. Calif., U. S., Jns.); ad Kingston, Sierra com., *Metcalfe*, n. 1381 pro parte (hbb. Mo., N. Y.); in declivitatibus apertis montium Mogollon, *Rusby*, nn. 238½ (hb. Gray.), 239½ (hb. Gray.).

ARIZONA: in parte australi, *Lemmon*, nn. 309 (hb. Gray.), 311 (hb. Gray.); prope Portal, Cochise com., *Eggleston*, n. 11,031 (hb. U. S.); in dumetis saxosis montium Rincon, *Blumer*, n. 3355 pro parte (hbb. Mo., Univ. Calif.); in montibus Santa Rita, *Engelmann* (hb. Mo.); ad angus-

tias Apache nominatas, *Lemmon*, n. 366 (hb. Gray.); in montibus Huachuca, *Lemmon*, n. 2736 (hb. U. S.); in montibus San Francisco, *MacDougal*, n. 365 pro parte (hbb. Univ. Calif., N. Y., U. S.).

CALIFORNIA: ad angustias Sonora, alt. 1525–1830 m., *Purpus*, n. 6448 (hbb. Univ. Calif., N. Y., U. S.).

CALIFORNIA INFER. BOR.: ad Hansen's, *C. R. Orcutt*, n. 1252 (hbb. Gray., Univ. Calif.).

FIG. 89. B. amblyolepis.

85. B. AMBLYOLEPIS Robinson, Proc. Am. Acad. xxxvi. 485 (1901)

Herbacea erecta elata subglabra 2–2.5 m. alta; caule crasso fistuloso laevi folioso purpureo viridi-maculato; foliis verticillatis vel superne suboppositis petiolatis ovatis crenato-serratis utroque acuminatis utrinque viridibus supra glabris subtus in costis paullo puberulis margine tenuiter ciliatis 6–12 cm. longis 3–6 cm. latis supra basin 3-costatis, petiolo 1.5–3 cm. longo; capitulis laxe paniculatis valde nutantibus ca. 30-floris ca. 13 mm. diametro; involucri squamis herbaceis plerisque spatulato-oblongis 3–4-seriatim imbricatis 3–4-striatis apice rotundatis extimis saepe recurvatis; corollis ex involucro longe exsertis ca. 6.5 mm. longis; achaeniis 5 mm. longis brunneis minute pubescentibus; pappi setis ca. 40 multo inaequalibus paullulo rigidiusculis barbellatis sordido- vel fulvescenti-albis. — Species australi-mexicana bene distincta nullis arcte affinis. (FIG. 89.)

MEXICO AUST.: GUERRERO: in montibus supra Igualam, alt. 1067 m., *Pringle*, n. 8415 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.). MORELOS: ad Yautepec, *Pringle*, sine numero (hb.U. S.).

86. B. FENDLERI Gray, Pl. Fendl. 63 (1849)

Erecta vel paullo decumbens crispe puberula subherbacea pluricaulis 4–8 dm. alta; radice lignescente; caulibus foliosis plerisque ad inflorescentiam simplicibus; foliis suboppositis vel alternis bene petiolatis deltoideo-ovatis vel ovato-lanceolatis serrato-dentatis vel -crenatis acutis vel attenuatis basi saepissime late cordatis rarius subtruncatis vel rotundatis tenuibus a basi 3-nerviis 3–7.5 cm. longis 1.5–4.5

cm. latis, petiolo 6–34 mm. longo; inflorescentia subdense paniculata terminali supra rotundata vel pyramidata; capitulis ca. 30–35-floris 9–12 mm. altis 6–7 mm. diametro primo brevissime deinde longius et graciliter pedicellatis saepe nutantibus; involucri squamis tenuibus lanceolato- vel elliptico-oblongis vel extimis ovatis 2–3-striatis pallide viridibus apice rotundatis vel modice acutatis margine ciliatis dorso plus minusve puberulis; receptaculo glabro; corollis albidis 4 mm. longis, faucibus saepe aliquid distinctis tubum proprium subaequantibus; achaeniis ca. 2.5 mm. longis inaequaliter 5-angulatis cum vel absque costulis 1–5 intermediis. — Species Civ. Foed. aust.-occ. incolens, affinitate generico dubia locum inter *Brickelliam* et *Eupatorium* quasi intermedium tenens. (FIG. 90.)

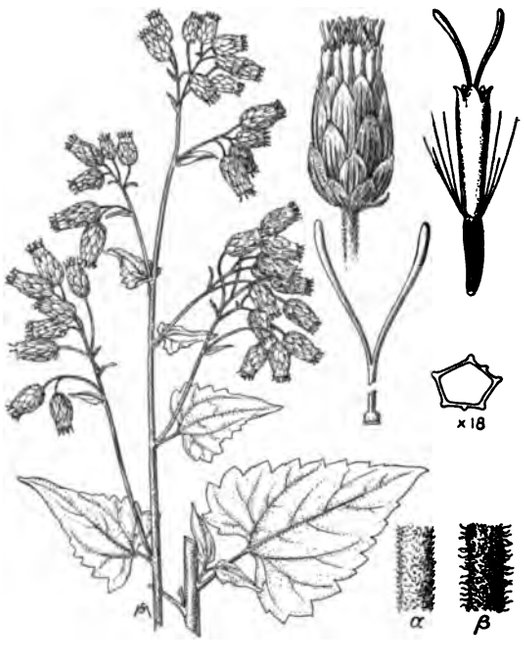

FIG. 90. B. Fendleri.

Gray, Pl. Wright. i. 85 (1852).
Eupatorium Fendleri Gray, Proc. Am. Acad. xvii. 205 (1882), & Syn. Fl. i. pt. 2, 96 (1884).
Coleosanthus ambigens Greene, Bull. Torr. Bot. Club, xxv. 118, t. 330 (1898).
C. modestus Greene, Pittonia, iv. 236 (1901).
C. Fendleri (Gray) Greene, l. c. 237 (1901).
Brickellia ambigens (Greene) Nels. Man. Bot. Rky. Mts. 486 (1909) excl. pll. coloradens. et utahens.

NEO-MEXICO: in loco Spring Cañon dicto, Colfax com., *Wooton* (hb. U. S.); prope Brazos Cañon, Rio Arriba com., *Standley & Bollman*, n. 10,650 (hb. U. S.); millibus passuum 11 supra Santa Fé, *Fendler*, nn. 307 (hbb. Gray., Mo.), 347 (hbb. Gray., Mo., Brown Univ., Phil., U. S.); ad valliculam praeruptam Santa Fé, *Rose, Fitch & Parkhurst*, n. 17,729 (hbb. N. Y., U. S.); in declivitatibus montium prope metalla aenea, *Wright*, n. 1142 (hbb. Gray., Phil.); prope Pecos, alt. 2043 m., *Standley*, n. 5198 (hbb. Mo., N. Y., U. S.); ad ostium rivuli Indian dicti, alt. 2440 m., *Standley*, n. 4559 (hbb. Gray., Mo., N. Y., U. S.); in calcareis humidis ad Las Vegas, *Engelmann* (hb. Mo.); ab Albuquerque ad or. spect., *Jones* (hb. Jns.); ad Pajarito, *Brandegee* (hbb. Gray., Univ. Calif.); in montibus Albis, Lincoln com., alt. 2135 m., *Wooton*, nn. 335 (hbb. Gray., Mo., Univ. Calif., Univ. Wyo., N. Y., U. S., Jns.), 3940 (hb. U. S.); prope culmen Gray, Lincoln com., alt. 1830–1982 m., *F. S. & E. S. Earle*, n. 161 (hbb. Mo., N. Y., U. S.); ibid., alt. 1830 m., *Skehan*, n. 105 (hbb. Mo., N. Y., U. S.); ad Cloudcroft in montibus Sacramento, *Wooton* (hbb. Mo., Univ. Calif., Univ. Wyo., N. Y., U. S., Jns.); in montibus Magdalena, *Diehl*, n. 509 (hb. Jns.); ad terminum aust. montium Nigrorum, Sierra com., alt. 2592 m., *Metcalfe*, n. 1183 (hb. Mo.); in montibus Pinos Altos, *Greene* (hb. Jns.); in montibus Mogollon, *Rusby*, n. 240 (hb. Gray.); ibid., alt. 2287 m., *Metcalfe*, n. 358 (hbb. Gray., Univ. Calif.).

ARIZONA: in montibus Chiricahua, *Lemmon*, n. 312 (hb. Gray.); *Eggleston*, n. 10,790 (hb. U. S.); in montibus Rincon, alt. 2440 m., *Blumer*, n. 3442 (hbb. Gray., Univ. Calif.).

Var. *α.* **typica,** caule pedicellisque breviter griseo-puberulis; pilis prorsus curvatis cum vel absque glandulis paucis obscuris intermixtis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. *β.* **nepetaefolia** (Greene), comb. nov., caule supra et pedicellis non solum puberulis sed etiam patenter visciduleque pubescentibus; pilis longioribus septatis quasi moniliformibus attenuatis. (Fig. 90 *β.*)

Coleosanthus nepetaefolius Greene, Pittonia, iv. 237 (1901).

NEO-MEXICO: ad Gray, Lincoln com., alt. 1830–1982 m., *F. S. & E. S. Earle,* n. 458 (hbb. Mo., N. Y., U. S., phot. in hb. Gray.).

87. B. HYMENOCHLAENA Gray, Proc. Am. Acad. xv. 29 (1879)

Herbacea erecta 3–5 dm. alta crispe puberula; radice tuberosa; caule solitario plerumque simplici a basi ad mediam partem folioso superne remote bracteato rarium superne ramoso et folioso; foliis plerisque oppositis deltoideo-ovatis vel ovato-oblongis crenato-dentatis plerisque obtusis basi rotundatis vel subtruncatis vel late cordatis supra puberulis subtus paullo pallidioribus glanduloso-punctatis et praecipue in costis venisque crispe puberulis; capitulis ad apicem caulis subumbellatim corymbosis ca. 40-floris 15 mm. altis 11 mm. diametro; involucri squamis tenuibus oblongo-lanceolatis purpureis subglabris membranaceis acutis vel acuminatis 6–8-striatis laxe imbricatis, extimis paucis dimidio brevioribus subherbaceis puberulis; corollis 7.5 mm. longis cum tubo brevi et faucibus proportione elongatis cylindricis limbum versus purpureis, dentibus limbi extus glandulosis; styli ramis clavatis atropurpureis; achaeniis 4 mm. longis villosis; pappi setis ca. 40 tenuiter capillaribus distincte barbellatis caducis. (Fig. 91.)

Fig. 91. B. hymenochlaena.

Hemsl. Biol. Cent.-Am. Bot. ii. 105 (1881).
Coleosanthus hymenochlaenus (Gray) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT. et AUST.: San Luis Potosi: in collibus prope urbem ita nominatam, *Parry & Palmer*, n. 349 (hbb. Gray., Mo., Phil., U. S.); in montibus prope San Miguelito, *Schaffner*, nn. 256 (hbb. Gray., N. Y., U.S., Hafn.), 694 (hbb. N. Y., U.S., Hafn.). Puebla: silvis quercorum in Cerro de Oro, alt. 2745–3050 m., *Purpus*, n. 3846 (hbb. Gray., Mo., Univ. Calif., N. Y., U.S.). Oaxaca: in Sierra de San Felipe, alt. 1067 m., *Pringle*, n. 4698 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.); in montibus Jayacatlan, *L. C. Smith*, n. 482 (hb. Gray.); in Cerro Verde, *Purpus*, n. 3141 (hbb. Gray., Mo., Univ. Calif.). Hidalgo: ad Zimapan, *Coulter*, n. 239 (hb. Gray.). Planta elegantissima f. Schaffneri. An horticulturae digna ?

88. B. simplex Gray, Pl. Wright. ii. 73 (1853)

Herbacea gracilis erecta vel paullo decumbens simplex vel modice ramosa aspectu glabra sed minute puberula; caudice lignescente; caulibus 1–4 vel pluribus foliosis; foliis oppositis vel alternis subhastato-deltoideis grosse crenato-dentatis acutis vel obtusis late cordatis paullo firmiusculis utrinque viridibus subconcoloribus 1–6 cm. longis 0.7–5 cm. latis, petiolo 3–20 mm. longo; foliis supremis saepe hastato-lanceolatis; capitulis vel solitariis terminalibus vel paucis ca. 60-floris erectis vel saepe nutantibus longipedunculatis ca. 19 mm. altis 12 mm. diametro; involucri campanulati squamis ca. 60 lanceolati-linearibus attenuatis 4–6-striatis subglabris laxe imbricatis, extimis brevioribus subfiliformibus minute tomentellis; receptaculo glabro; corollis ca. 1 cm. longis albidis; achaeniis 4–4.6 mm. longis fuscis sursum in costis hispidulis; pappi setis ca. 36 albis sublaevibus. (Fig. 92.)

Fig. 92. B. simplex.

Gray, Syn. Fl. i. pt. 2, 105 (1884).
Coleosanthus simplex (Gray) Ktze. Rev. Gen. i. 328 (1891).

ARIZONA AUST.: *Lemmon*, nn. 305 (hb. Gray.), 310 (hbb. Gray., Univ. Calif.); in montibus Huachuca, *Holzner*, n. 2009 (hb. U. S.), *Jones* (hbb. U. S., Jns.), *Wilcox*, n. 471 (hb. U. S.).

MEXICO BOR.-OCC.: Sonora: in collibus ab Santa Cruz ad or. spect., *Wright*, n. 1144 (hbb. Gray., Mo., Univ. Columb., Phil., U. S.), *Thurber*, n. 1011 (hb. Gray.). Chihuahua: in collibus petrosis, *Pringle*, nn. 641 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.), 1070 (hbb. Mo., Columb. Univ.); *Palmer* (anno 1885), n. 436 (hbb. Gray., J. D. Sm., Columb. Univ., Phil., U. S.); *Hartman*, n. 787 (hbb. Gray., J. D. Sm., Univ. Calif., N. Y., U. S.); *Goldman*, n. 172 (hbb. Gray., N. Y., U. S.); *E. W. Nelson*, n. 6222 (hbb. Gray., U. S.); *Townsend & Barber*,

nn. 280 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S., Jns.), 420 (hbb. Gray., Mo., N. Y., U. S., Jns.); ad Chuichupam, in Sierra Madre, alt. 2135 m., *Jones* (hbb. Gray., Mo.); ad coloniam Juarez, *Jones* (hb. Jns.); ad Guayanopa Cañon, alt. 1525 m., *Jones* (hb. Jns.); in mesa prope valliculam Hop dictam, alt. 2135 m., *Jones* (hb. Jns.).

89. B. INCANA Gray, Proc. Am. Acad. vii. 350 (1868)

Incano-tomentosa ramosissima basi lignescens; caule ramisque vel erectis vel adscendentibus teretibus juventate niveo-tomentellis tardius glabratis et cum cortice argentea longitudinaliter fissa tectis; foliis alternis sessilibus orbiculari-ovatis coriaceis serrulatis vel integerrimis primo utrinque albo-tomentosis tardius plus minusve glabratis 1–2 cm. longis subaequilatis, supremis ovatis acutis; capitulis ramos terminantibus solitariis pro genere magnis ad 2.5 cm. altis ca. 2 cm. diametro ca. 60-floris; involucri turbinato-campanulati squamis arcte pluriseriatimque imbricatis ovato-oblongis vix acutis dorso albo-tomentosis; corollis graciliter tubulatis 14 mm. longis; achaeniis ca. 1 cm. longis sericeis; pappi setis ca. 43 sordide albis laeviusculis. — Species notabilis xerophytica distributione aliquid restricta. (FIG. 93.)

FIG. 93. B. incana.

Gray, Bot. Calif. i. 300 (1876), & Syn. Fl. i. pt. 2, 104 (1884); Hall, Univ. Calif. Pub. Bot. iii. 30 (1907).

Coleosanthus incanus (Gray) Ktze. Rev. Gen. i. 328 (1891).

CALIFORNIA AUST.: in desertis Mohave: in montibus Providence, *Cooper* (hb. Gray.), *T. S. Brandegee* (hb. Univ. Calif.); ad Leastalk, *S. B. Parish*, n. 10,242 (hbb. Gray., Univ. Calif.); prope locum " The Needles " anglice dictum, *T. S. Brandegee* (hb. Univ. Calif.); ad fontes Cushenberry, *Parish frat.*, n. 1248 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Columb. Univ., U. S.), *S. B. Parish*, nn. 2387 (hb. Univ. Calif.), 2388 (hbb. Univ. Calif., Columb. Univ.); ad Daggett, *K. Brandegee* (hb. Univ. Calif.); in desertis Colorado dictis ad Chuckawalla Wash, *Schellenger*, n. 98 (hb. Univ. Calif.); ad fontes Cottonwood, alt. 792 m., *S. B. Parish*, n. 10,848 (hb. Gray.); sine loco exactiore, *Parry*, n. 1 (hb. Gray.).

NEVADA OCC.: in sabuletis ad locum " Ash Meadows " anglice nominatum, *Purpus*, n. 6041 (hbb. Univ. Calif., N. Y., U. S.).

90. B. LANATA (DC.) Gray, Pl. Wright. i. 84 (1852)

Subherbacea vel plus minusve fruticosa griseo- vel albo-lanata; caulibus vel simplicibus vel a basi ramosis 3–4 dm. altis foliosis; foliis plerisque oppositis ellipticis subsessilibus vel breviter (ad 9 mm. longe) petiolatis rigidis argute serrato-dentatis juventate utrinque lanato-tomentosis tardius supra plus minusve glabratis et bullatis et cum basibus pilorum scabridis 3–5.5 cm. longis 1.7–3 cm. latis; capitulis ca. 50-floris ca. 14 mm. altis 9 mm. diametro plerisque in axillis superioribus oppositis longiuscule pedicellatis et laxe racemosis; involucri squamis ca. 56 ovatis vel oblongis mucronatis firmis arcte imbricatis appressis saepius purpurascentibus 8–10-striatis arachnoideo-ciliatis; corollis 8 mm. longis; styli ramis subfiliformibus vix clavellatis; achaeniis 4 mm. longis fulvo-sericeis; pappi setis ca. 40 albis sublaevibus. (FIG. 94.)

FIG. 94. B. lanata.

Bulbostylis lanata DC. Prod. vii. 268 (1838).
Bolbostylis rigida Hook. & Arn. Bot. Beech. 297 (1840), forma inter varr. α et β quasi intermedia.
Bulbostylis rigida (Hook. & Arn.) Hemsl. Biol. Cent.-Am. Bot. ii. 106 (1881) in synon.
Coleosanthus lanatus (DC.) Ktze. Rev. Gen. i. 328 (1891).

MEXICO CENT.: ab urbe Guanajuato ad occ. spect., *Mendez* (hbb. DC., Gray.). JALISCO: in declivitatibus siccis vallicularum praeruptarum hispanice "barrancas" dictarum prope Guadalajaram, *Palmer* (anno 1886), n. 450 (hbb. Gray., Mo., J. D. Sm., Phil., U. S.), *Pringle*, n. 1757 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., Phil., U. S.); in collibus petrosis secundum flumen Blanco, alt. 1525 m., *Pringle*, n. 11,495 (hbb. Gray., U. S.); inter Colotlan et Bolañon, *Rose*, n. 2842 (hbb. Gray., U. S.); in collibus cretaceis ad Chapalam, *Rose & Painter*, n. 7631 (hb. U. S.). TEPIC? *Beechey* (fragm. in hb. Gray.), forma ad var. β transiens.

Var. α. **typica,** foliis basi angustatis distincte quamquam breviter petiolatis grosse arguteque dentatis, dentibus 2–5 mm. altis. — Synon. et distrib. et exsicc. ut supra dictae.

Var. β. **microdonta,** var. nov., foliis subsessilibus basi cordatis plus minusve amplexicaulibus breviter mucronato-denticulatis, dentibus vix 1 mm. longis. (FIG. 94 β.)

MEXICO OCC.: COLIMA: *Palmer* (anno 1891), n. 1149 (spec. typ. in hbb. Gray., J. D. Sm., N. Y., U. S.). JALISCO: ad Tuxpan, *Purpus*, n. 492 (hbb. Mo., Univ. Calif., U. S.).

SECT. 9. MACROBRICKELLIA, SECT. NOV.

Capitula pro genere maxima solitaria. Involucri squamae nonnullae apice paullo expansae in appendices suborbiculares terminantes. Corolla cum tubo brevissimo proprio et faucibus cylindricis longis modice differentiatis. — Species unica centrali-mexicana herbacea caudice tuberosa.

91. B. MONOCEPHALA Robinson, Proc. Bost. Soc. Nat. Hist. xxxi. 268 (1904)

Erecta viridis puberula 4–8 dm. alta; caule plerumque solitario simplici ad mediam partem folioso; foliis alternis et oppositis ovatis integerrimis vel undulatis vel paullo dentatis 3-nerviis apice angustatis sed obtusis basi rotundatis vel subcordatis 2.5–5 cm. longis 17–34 mm. latis utrinque viridibus puberulis punctatis; petiolo 6–15 mm. longo; capitulo solitario terminali longe pedunculato nutante ca. 100-floro 2 cm. alto 2–3 cm. diametro; involucri late campanulati squamis 3–6-striatis, extimis lanceolatis acutis pubentibus subherbaceis, intermediis oblongis apice plus minusve in appendicem rotundatam transverse rugosam eroso-ciliatam expansis dorso pubescentibus saepius coloratis, intimis oblanceolato-linearibus acutis; corollis 9 mm. longis, tubo proprio ca. 2 mm. longo basi modo generis a basi styli dilatato supra basin aliquid constricto, faucibus cylindricis elongatis, dentibus limbi deltoideis dorso glandulari-atomiferis; achaeniis 6 mm. longis fusco-brunneis superne paullo villosis; pappi setis ca. 30 distincte barbellatis subplumosis. (FIG. 95.)

FIG. 95. B. monocephala.

MEXICO CENT.: HIDALGO: in collibus prope El Salto, alt. 2135 m., *Pringle*, nn. 8621 (hbb. Gray., Mo., J. D. Sm., Univ. Calif., N. Y., Phil., U. S.), 13,035 (hbb. Gray., U. S.). DURANGO: ad Otinapam, *Palmer* (anno 1906), n. 360 (hbb. Gray., Mo., Univ. Calif., N. Y., U. S.).

SPECIES DUBIAE VEL TRANSFERENDAE VEL CUM GENERE SUB ALIQUO NOMINE CONFUSAE

(Synonyma vera supra locata non inclusa; pro his vide indicem.)

Bolbostylis Cassiniana Gardn. in Hook. Lond. Jour. Bot. v. 471 (1846) = pro parte (quoad Gardneri n. 4849) EUPATORIUM VAUTHIERIANUM DC. Prod. v. 159 (1836), et pro parte (quoad Gardneri n. 4853) E. VAUTHIERIANUM, var. RAMOSISSIMUM (Gardn.) Bak. in Mart. Fl. Bras. vi. pt. 2, 304 (1876).

Bolbostylis elegans Gardn. l. c. 467 (1846) = E. AMYGDALINUM, var. ELEGANS (Gardn.) Bak. l. c. 313 (1876).

Bolbostylis glandulosa Gardn. l. c. 469 (1846) = E. AMYGDALINUM, var. GLANDULOSUM (Gardn.) Bak. l. c. 314 (1876).

Bolbostylis microcephala Gardn. l. c. 468 (1846) = E. AMYGDALINUM Lam. Dict. ii. 408 (1786).

Bolbostylis oblongifolia Gardn. l. c. 469 (1846) = E. TRIXOIDES Mart. ex Bak. in Mart. Fl. Bras. vi. pt. 2, 311 (1876), non *E. oblongifolium* (Spreng.) Bak. l. c.

Bolbostylis pumila Gardn. l. c. 470 (1846) = E. AMPHIDICTYUM DC. Prod. v. 163 (1876) fide Bak. l. c. 309 (1876).

Bolbostylis ramosissima Gardn. l. c. 471 (1846) = E. VAUTHIERIANUM, var. RAMOSISSIMUM (Gardn.) Bak. l. c. 304 (1876).

Bolbostylis scandens Gardn. l. c. 470 (1846) = E. VITALBAE DC. Prod. v. 163 (1836).

Bolbostylis tomentosa Gardn. l. c. 468 (1846) = E. AMYGDALINUM, var. OXYCHLAENUM (DC.) Bak. l. c. 314 (1876).

Brickellia Cumingii Klatt, Abhandl. Naturf. Gesellsch. Halle, xv. 325 (1882) et per impressionem separatam antecedentem pagina 5 (1881) = CHRYSOPSIS OREGANA (Nutt.) Gray, Proc. Am. Acad. vi. 543 (1865).

Brickellia linearifolia Klatt. ll. cc. = BIGELOWIA VISCIDIFLORA (Hook.) DC. Prod. vii. 279 (1838).

Brickellia microphylla (DC.) Hieron. in Engl. Bot. Jahrb. xxviii. 583 (1901), non Grayi. *Baccharis microphylla* DC. Prod. v. 406 (1836), non HBK. *Baccharis Candolleana* Steud. Nom. ed. 2, i. 177 (1841). Fragmentum hujus speciei speciminis typici a cl. Dr. C. de Candolleo benevolente accommodatum exhibet achaenia 5-angulata (vide fig. 96) ut apud *Eupatorium* et ab forma achaenii 10-costati generis *Brickelliae* longe differentia. Profecto congruit omnino cum genere *Eupatorio* styli ramis, antheris, achaeniis, pappi setis, etc. Ob homonyma valida priora pro nomina omnia hucusque proposita propono pro speciem **Eupatorium incarum,** nom. nov. (FIG. 96.)

FIG. 96. Eupatorium incarum.

BRICKELLIA PAUCIDENTATA Klatt, "herbacea hirsuta, caulibus foliosis, foliis lanceolatis sessilibus cuspidatis apice paucidentatis, capitulis circiter 20-floris in paniculam spiciformem digestis, squamis involucri lanceolatis acutiusculis margine membranaceis, extimis brevibus, achaeniis pubescentibus, pappo plumoso rufo. Hab.: Sta. Cruz [Bolivia], leg. A. d'Orbigny No. 558." — Abhandl. Naturf. Gesellsch. Halle, xv. 326 (1882) et per impressionem separatam antecedentem pagina 6 (1881). Haec planta in herbario Klattiano non reperta est omnino dubia et verisimiliter generi aliena, ut *B. Cumingii* Klatt (= *Chrysopsis oregana*) et *B. linearifolia* Klatt (= *Bigelowia viscidiflora*) in opere eodem vulgatae.

Bulbostylis annua Nutt. Proc. Acad. Philad. 1848, p. 22 (Feb. 1848), & Jour. Acad. Philad. ser. 2, i. 179 (Aug. 1848) = PSATHYROTES ANNUA (Nutt.) Gray, Pl. Wright. ii. 100 (1853).

Bulbostylis Cassiniana (Gardn.) Bak. in Mart. Fl. Bras. vi. 304 (1876) = EUPATORIUM VAUTHIERIANUM et var. Vide supra sub *Bolbostyle.*

Bulbostylis deltoides Buckl. Proc. Acad. Philad. 1861, 456 (1861) = EUPATORIUM HAVANENSE HBK. Nov. Gen. et Spec. iv. 128 (1820).

Bulbostylis elegans (Gardn.) Bak. l. c. 313 (1876) = EUPATORIUM AMYGDALINUM, var. ELEGANS (Gardn.) Bak. l. c.

Bulbostylis glabra DC. Prod. v. 139 (1836) = E. VAUTHIERIANUM, var. GLABRIUSCULUM (DC.) Bak. l. c. 304 (1876).

Bulbostylis glandulosa (Gardn.) Bak. l. c. 314 (1876) = E. AMYGDALINUM, var. GLANDULOSUM (Gardn.) Bak. l. c.

Bulbostylis micrantha Gardn. in Hook. Lond. Jour. Bot. vi. 449 (1847) = E. AMYGDALINUM, var. OXYCHLAENUM (DC.) Bak. l. c.

Bulbostylis microcephala (Gardn.) Bak. l. c. 313 (1876) = E. AMYGDALINUM Lam. Dict. ii. 408 (1786).

Bulbostylis oblongifolia (Gardn.) Bak. l. c. 311 (1876) = E. TRIXOIDES Mart. ex Bak. l. c.

Bulbostylis ? pauciflora (HBK.) DC. Prod. v. 139 (1836) = E. PAUCIFLORUM HBK. Nov. Gen. et Spec. iv. 120 (1820).

Bulbostylis pedunculosa DC. Prod. v. 138 (1836) = E. LONGIPES Gray, Proc. Am. Acad. xv. 26 (1879).

Bulbostylis pumila (Gardn.) Bak. in Mart. Fl. Bras. vi. pt. 2, 309 (1876) = E. AMPHIDICTYUM DC. Prod. v. 163 (1836) fide Bak. l. c.

Bulbostylis ramosissima (Gardn.) Bak. l. c. 304 (1876) = E. VAUTHIERIANUM, var. RAMOSISSIMUM (Gardn.) Bak. l. c.

Bulbostylis scandens (Gardn.) Bak. l. c. 305 (1876) = E. VITALBAE DC. Prod. v. 163 (1836).

Bulbostylis scorodoniaefolia Kunth, Ind. Sem. Hort. Berol. 1846, p. 12 (1847); Ann. Sci. Nat. sér. 3, vii. 187 (1847); Walp. Rep. vi. 709 (1847). Hujus speciei a cll. Hookero f. et Jacksonio, Ind. Kew. i. 356, ad *Brickelliam californicam* dubitative et per errorem reductae specimen definitive typicum ut videtur non exstat. Tamen reperiunter specimina dua in herbario Horti Regii Berolinensis sub nomine "*Eupatorium rigidum* Benth." qua in horto eodem Apr. 1846 (ita contemporanea cum typo Kunthii) floruerunt et cum descriptione Kunthii optime quadrant. De fragmentis et ab photographiis per benignitatem cl. L. Dielsii, directoris Hort. Reg. Berol. receptis existimo plantam nullo modo ab BRICKELLIA SECUNDIFLORA (Lag.) Gray distingueri potesse.

Bulbostylis spinaciaefolia DC. Prod. v. 139 (1836) = EUPATORIUM SPINACIAEFOLIUM (DC.) Gray, Bot. Mex. Bound. 75 (1859).

Bulbostylis subuligera Schauer, Linnaea, xix. 718 (1847) = BARROETEA SUBULIGERA (Schauer) Gray, Proc. Am. Acad. xv. 29 (1879).

Bulbostylis tomentosa (Gardn.) Bak. in Mart. Fl. Bras. vi. pt. 2, 314 (1876) = EUPATORIUM AMYGDALINUM, var. OXYCHLAENUM (DC.) Bak. l. c.

Bulbostylis triangularis DC. Prod. vii. 268 (1838) = E. VITIFOLIUM (Sch. Bip.) Klatt, Leopoldina, xx. 90 (1884); vide Robinson, Proc. Am. Acad. li. 537 (1916).

Coleosanthus tiliaefolius Cass. Bull. Soc. Philom. 1819, p. 157 (1819) et Dict. xxiv. 519 (1822) = E. MACROPHYLLUM L. Sp. Pl. ed. 2, ii. 1175 (1763).

Eupatorium axillare Moc. ex DC. Prod. v. 138 (1836) in synon. *Bulbostylis Cavanillesii* DC. (speciei valde mixtae) solum vulgatum est nomen nullo modo validum.

LIST OF EXSICCATAE

Abrams

3665 frutescens Gray
4173 californica (T. & G.) Gray

Adams

3 californica (T. & G.) Gray
20 " " "

Alexander

diffusa (Vahl) Gray

Alvarez

729 paniculata (Mill.) Robinson

Anderson, F. A.

190 grandiflora (Hook.) Nutt.

Anderson, M.

grandiflora (Hook.) Nutt.

Andrews

81 laciniata Gray

Anthony

peninsularis Brandegee

Arsène

secundiflora (Lag.) Gray, v. nepetaefolia (HBK.) Robinson

Austin

217 oblongifolia, v. linifolia (D. C. Eaton) Robinson
309 microphylla (Nutt.) Gray
375 Greenei Gray
383 grandiflora (Hook.) Nutt.
565 arguta Robinson

Babcock

californica (T. & G.) Gray

Baker, C. F.

656 grandiflora (Hook.) Nutt.
657 oblongifolia, v. linifolia (D. C. Eaton) Robinson
680 grandiflora (Hook.) Nutt.
908 scabra (Gray) Nels.
2163 pacayensis Coult.
2167 diffusa (Vahl) Gray
2202 paniculata (Mill.) Robinson
2317 " " "
3696 californica (T. & G.) Gray
3731 Nevinii Gray
4568 californica (T. & G.) Gray

Baker, H. P.

grandiflora (Hook.) Nutt.

Baker, M. S.

282 californica (T. & G.) Gray, ad v. Jepsonii Robinson transiens
grandiflora (Hook.) Nutt.

Barclay

hastata Benth.

Barkelew

198 peninsularis Brandegee

Barroeta

squamulosa Gray

Bates

3002 grandiflora (Hook.) Nutt.
secundiflora (Lag.) Gray
veronicaefolia (HBK.) Gray

Beals

Lemmoni, v. Wootoni (Greene) Robinson
venosa (Wooton & Standley) Robinson

Beard

Coulteri Gray

Beechey

hebecarpa (DC.) Gray
lanata (DC.) Gray

Berg

cordifolia Ell.

Berlandier

106 laciniata Gray
115 veronicaefolia (HBK.) Gray
275 diffusa (Vahl) Gray
508 cylindracea Gray & Engelm.
513 dentata (DC.) Sch. Bip.
669 " " " "
727 diffusa (Vahl) Gray
757 secundiflora (Lag.) Gray, v. nepetaefolia (HBK.) Robinson
1074 scoparia (DC.) Gray
1247 secundiflora (Lag.) Gray, v. nepetaefolia (HBK.) Robinson
1250 veronicaefolia (HBK.) Gray
1288 " " "
1293 " " "
1307 partim veronicaefolia (HBK.) Gray; partim veronicaefolia, v. petrophila Robinson
1365 laciniata Gray
1374 veronicaefolia (HBK.) Gray
1783 laciniata Gray
1833 cylindracea Gray & Engelm.
1883 " " " "
1893 dentata (DC.) Sch. Bip.
1897 " " " "
2079 " " " "
2081 " " " "
2144 diffusa (Vahl) Gray
3162 veronicaefolia (HBK.) Gray
3163 diffusa (Vahl) Gray

Bertero

diffusa (Vahl) Gray

Bigelow

7 californica, v. reniformis (Gray) Robinson
baccharidea Gray
brachyphylla Gray
californica (T. & G.) Gray
cylindracea, v. laxa Gray
dentata (DC.) Sch. Bip.
grandiflora (Hook.) Nutt.

Bishop

longifolia Wats.

Blochman

californica (T. & G.) Gray

Blumer

20 grandiflora (Hook.) Nutt.
66 californica (T. & G.) Gray
N134 floribunda Gray
N153 betonicaefolia Gray.
U210 floribunda Gray
1750 venosa (Wooton & Standley) Robinson
1766 maxima ex parte floribunda Gray; minima ex parte californica (T. & G.) Gray
1786 maxima ex parte Lemmoni Gray; minima ex parte venosa (Wooton & Standley) Robinson.
1795 betonicaefolia Gray
2226 floribunda Gray
2244 grandiflora (Hook.) Nutt.
3355 partim grandiflora (Hook.) Nutt.; partim ejusdem v. petiolaris Gray
3403 Rusbyi Gray
3442 Fendleri Gray
3620 californica (T. & G.) Gray

Bodin

173 dentata (DC.) Sch. Bip.
174 cylindracea Gray & Engelm.

Bolander

2625 californica (T. & G.) Gray
5030 grandiflora (Hook.) Nutt.

Botteri

510 scoparia (DC.) Gray
612 " " "
1112 Botterii Robinson
1113a oliganthes (Less.) Gray
1115 partim pacayensis Coult.; partim Botterii Robinson
adenocarpa Robinson
pacayensis Coult.

Bourgeau

1088 veronicaefolia (HBK.) Gray
1091 secundiflora (Lag.) Gray
1227 nutans (HBK.) Robinson
1974 pacayensis Coult.

2033 diffusa (Vahl) Gray
3345 scoparia (DC.) Gray

Boykin

cordifolia Ell.

Brandegee, E. N.

grandiflora (Hook.) Nutt.

Brandegee, K.

atractyloides Gray
californica (T. & G.) Gray
frutescens Gray
incana Gray
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Brandegee, T. S.

74 oblongifolia Nutt.
156 oblongifolia Nutt., f. foliis dentatis
281 Coulteri Gray
508 grandiflora (Hook.) Nutt.
835 " " "
836 oblongifolia Nutt.
844 californica (T. & G.) Gray
1133 scabra (Gray) Nels.
1178 oblongifolia, v. linifolia (D. C. Eaton) Robinson
amplexicaulis Robinson
arguta Robinson
arguta, v. odontolepis Robinson
Brandegei Robinson
californica (T. & G.) Gray
Coulteri Gray
diffusa (Vahl) Gray
Fendleri Gray
frutescens Gray
grandiflora (Hook.) Nutt.
Greenei Gray
hastata Benth.
incana Gray
oblongifolia Nutt., f. foliis dentatis
peninsularis Brandegee
scabra (Gray) Nels.
Watsonii Robinson

Braunton

17 Nevinii Gray
517 " "
730 californica (T. & G.) Gray
1183 " " "

Bridges

245 californica (T. & G.) Gray
246 grandiflora (Hook.) Nutt.

Brown

45 grandiflora (Hook.) Nutt.
grandiflora (Hook.) Nutt.

Bruce

383 grandiflora (Hook.) Nutt.

Buckley

cordifolia Ell.

Burchell

5480 brasiliensis (Spreng.) Robinson
5543/2 " " "
5778 " " "
7424 diffusa (Vahl) Gray

Bush

106 grandiflora (Hook.) Nutt.
168 " " "
1122 " " "
3507 " " "
4861 " " "
5361 " " "

Butler

305 grandiflora (Hook.) Nutt.
948 californica (T. & G.) Gray, ad v. Jepsonii Robinson transiens

Carpenter

grandiflora (Hook.) Nutt.

Chapman

266 cordifolia Ell.
cordifolia Ell.

Chestnut

399 californica (T. & G.) Gray
525 " " "
californica (T. & G.) Gray

Chestnut & Drew

californica (T. & G.) Gray

Clarke

212 grandiflora (Hook.) Nutt.

Claussen

brasiliensis (Spreng.) Robinson

Clemens

californica, v. tenera (Gray) Robinson
grandiflora (Hook.) Nutt.

Clements

63 californica (T. & G.) Gray
78 " " "
118 grandiflora (Hook.) Nutt.
275 grandiflora, v. petiolaris Gray

Cleveland

californica (T. & G.) Gray

Cockerell

grandiflora (Hook.) Nutt.

Congdon

californica (T. & G.) Gray

Conzatti

1332 orizabensis Klatt
2078 pendula (Schrad.) Gray

Conzatti & González

1089 paniculata (Mill.) Robinson
1265 tomentella Gray

Cooper

incana Gray
oblongifolia Nutt.

Cotton

710 oblongifolia Nutt.
819 " "

Coues & Palmer

387 californica (T. & G.) Gray
floribunda Gray

Coulter

239 hymenochlaena Gray
243 veronicaefolia, v. petrophila Robinson
293 Coulteri Gray

Coville & Funston

164 desertorum Coville
165 arguta Robinson
186 " "
943 oblongifolia, v. linifolia (D. C. Eaton) Robinson

Cowen

californica (T. & G.) Gray
grandiflora (Hook.) Nutt.

Crandall

2782 grandiflora (Hook.) Nutt.
2785 californica (T. & G.) Gray
2786 grandiflora (Hook.) Nutt.
grandiflora (Hook.) Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Crandall & Cowen

230 grandiflora (Hook.) Nutt.

Crawford

venosa (Wooton & Standley) Robinson

Emi e Cuming

114 californica (T. & G.) Gray

Curran

microphylla (Nutt.) Gray

Curtiss

1188 cordifolia Ell.

Cusick

670 oblongifolia Nutt.
2102 grandifolia (Hook.) Nutt.
2121 microphylla (Nutt.) Gray
2696 oblongifolia Nutt.
2935 Greenei Gray
microphylla (Nutt.) Gray
oblongifolia Nutt.

Davidson, A.

198 partim Coulteri Gray, partim floribunda Gray
203 venosa (Wooton & Standley) Robinson
286 amplexicaulis, v. lanceolata (Gray) Robinson
389 brachyphylla Gray
2761 oblongifolia, v. linifolia (D. C. Eaton) Robinson
betonicaefolia Gray

Davidson, C.

grandiflora (Hook.) Nutt.

Davis

atractyloides Gray

Davy

2716 californica (T. & G.) Gray

Deam

14 pacayensis Coult.
129 nutans (HBK.) Robinson
140 veronicaefolia, v. petrophila Robinson

Diehl

285 Rusbyi Gray
420 grandiflora (Hook.) Nutt.
509 Fendleri Gray
701 californica (T. & G.) Gray
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Diquet

secundiflora, v. nepetaefolia (HBK.) Robinson
Parryi Gray
veronicaefolia, v. petrophila Robinson

Dodge

grandiflora (Hook.) Nutt.

Douglas

californica (T. & G.) Gray
grandiflora (Hook.) Nutt.

Dugès

7 secundiflora, v. nepetaefolia (HBK.) Robinson
429 secundiflora, v. nepetaefolia (HBK.) Robinson
449 veronicaefolia, v. petrophila Robinson

Earle

161 Fendleri Gray
396 brachyphylla Gray
400 partim Rusbyi Gray, partim californica (T. & G.) Gray
458 Fendleri, v. nepetaefolia (Greene) Robinson
490 betonicaefolia Gray
502 grandiflora (Hook.) Nutt.
568 brachyphylla Gray, f. foliis majoribus Rusbyi Gray

Earle & Baker

772 cordifolia Ell.
857 " "
957 " "

Eastwood

213 californica (T. & G.) Gray
224 " " "
3065 desertorum Coville
brachyphylla Gray
californica (T. & G.) Gray
oblongifolia, v. linifolia (D. C. Eaton) Robinson
scabra (Gray) Nels.

Eccles

grandiflora (Hook.) Nutt.

Eggers

3436 diffusa (Vahl) Gray

Eggert

grandiflora (Hook.) Nutt.

Eggleston

6107 grandiflora (Hook.) Nutt.
10,658 californica (T. & G.) Gray
10,662 floribunda Gray
10,663 " "
10,665 californica (T. & G.) Gray
10,684 amplexicaulis Robinson
10,740 californica (T. & G.) Gray
10,790 Fendleri Gray
10,856 grandiflora (Hook.) Nutt.
10,893 betonicaefolia Gray
10,895 californica (T. & G.) Gray
10,913 " " "
10,915 floribunda Gray
10,920 " "
10,950 betonicaefolia Gray
10,975 baccharidea Gray
10,981 venosa (Wooton & Standley) Robinson
11,006 floribunda Gray
11,021 grandiflora, v. petiolaris Gray

Ehrenberg

494 veronicaefolia (HBK.) Gray
711 paniculata (Mill.) Robinson

Ellis

226 grandiflora (Hook.) Nutt.
325 californica (T. & G.) Gray
385 brachyphylla Gray

Elmer

369 oblongifolia Nutt.
1376 " "
4189 californica (T. & G.) Gray

Emrick

132 squarrosa, v. oligadena Robinson

Engelmann

amplexicaulis Robinson
californica (T. & G.) Gray
desertorum Coville
Fendleri Gray
grandiflora (Hook.) Nutt.
grandiflora, v. petiolaris Gray

Engelmann & Sargent

floribunda Gray

Ervendberg

310 paniculata (Mill.) Robinson

Fendler

303 brachyphylla Gray
306 grandiflora (Hook.) Nutt.
307 Fendleri Gray
308 californica (T. & G.) Gray
335 grandiflora (Hook.) Nutt.
339 brachyphylla Gray
346 californica (T. & G.) Gray
347 Fendleri Gray
633 diffusa (Vahl) Gray
1942 " " "

Flodman

816 grandiflora (Hook.) Nutt.

Frémont

grandiflora (Hook.) Nutt.

Friedrichsthal

diffusa (Vahl) Gray
paniculata (Mill.) Robinson

Fuertes

325 diffusa (Vahl) Gray

Galeotti

2073 adenocarpa Robinson
2104 Galeottii Gray
2105 veronicaefolia (HBK.) Gray
2187 pacayensis Coult.
2306 oliganthes (Less.) Gray ?

Gardner

1738 diffusa (Vahl) Gray
2898 brasiliensis, v. pernambucensis Robinson
4846 brasiliensis (Spreng.) Robinson
4847 " " "

Garrett

1061 grandiflora (Hook.) Nutt.
1590 " " "
1590a " " "
2064 Watsonii Robinson
2188 " "
californica (T. & G.) Gray

Gaumer

1080 diffusa (Vahl) Gray

Geiss

Greenei Gray

Geyer

452 grandiflora (Hook.) Nutt.
453 oblongifolia Nutt.

Ghiesbreght

553 partim scoparia (DC.) Gray, partim oliganthes (Less.) Gray

Glatfelter

grandiflora (Hook.) Nutt.

Glaziou

14,027 brasiliensis (Spreng.) Robinson
21,616 " " "

Goldman

113 Wislizeni Gray
129 odontophylla Gray
155 solidaginifolia Gray
172 simplex Gray
204 amplexicaulis Robinson
754 paniculata (Mill.) Robinson
1498 californica (T. & G.) Gray
1687 grandiflora (Hook.) Nutt.
1711 californica (T. & G.) Gray
2227 " " "

Goodding

475 floribunda Gray
481 venosa (Wooton & Standley) Robinson
678 atractyloides Gray
803 " "
890 Rusbyi Gray
908 (anno 1902) oblongifolia, v. linifolia (D. C. Eaton) Robinson
908 (anno 1910) californica (T. & G.) Gray
1347 Rusbyi Gray
1786 grandiflora (Hook.) Nutt.
1919 " " "
2172 pendula (Schrad.) Gray
2250 atractyloides Gray

Graham

secundiflora, v. nepetaefolia (HBK.) Robinson

Gray

atractyloides Gray
baccharidea Gray
Coulteri Gray

Greata

331 Nevinii Gray

Greene

25 squamulosa Gray
235 brachyphylla Gray
370 Rusbyi Gray
375 californica (T. & G.) Gray
393 betonicaefolia Gray
445 baccharidea Gray
459 amplexicaulis, v. lanceolata (Gray) Robinson
1012 Greenei Gray
1098 Coulteri Gray
amplexicaulis, v. lanceolata (Gray) Robinson
baccharidea Gray
brachyphylla Gray
californica (T. & G.) Gray
Fendleri Gray
floribunda Gray
Rusbyi Gray
scabra (Gray) Nels.
squamulosa Gray
venosa (Wooton & Standley) Robinson

Gregg

3 spinulosa Gray
89 veronicaefolia (HBK.) Gray
336 laciniata Gray
353 veronicaefolia (HBK.) Gray
440 " " "
479 Coulteri Gray
531 spinulosa Gray
613 veronicaefolia (HBK.) Gray

Griffiths

2133 baccharidea Gray
2345 Coulteri Gray
2435 " "
3456 californica (T. & G.) Gray
5499 grandiflora (Hook.) Nutt.
5863 scabra (Gray) Nels.
5938 Coulteri Gray
5942 baccharidea Gray
5943 venosa (Wooton & Standley) Robinson
5996 californica (T. & G.) Gray
6003 " " "
6084 " " "
7162 Rusbyi Gray
7164 " "
californica (T. & G.) Gray

Griffiths & Hunter

503 oblongifolia, v. linifolia (D. C. Eaton) Robinson
506 microphylla (Nutt.) Gray
529 " " "

Griffiths & Morris

377 microphylla (Nutt.) Gray

Griffiths & Thornber

64 californica (T. & G.) Gray
101 grandiflora (Hook.) Nutt.
147 californica (T. & G.) Gray
177 Rusbyi Gray
289 floribunda Gray

Grinnell

californica (T. & G.) Gray

Haenke

hebecarpa (DC.) Gray
reticulata (DC.) Gray

Hall, G. R.

desertorum Coville

Hall, H. M.

1888 oblongifolia, v. linifolia (D. C. Eaton) Robinson
2142 oblongifolia, v. linifolia (D. C. Eaton) Robinson
6016 arguta Robinson
8802 grandiflora (Hook.) Nutt.
9590 californica (T. & G.) Gray, ad v. Jepsonii Robinson transiens

Hall & Chandler

6775 arguta Robinson
6916 Knappiana Drew
6930 arguta Robinson

Hall & Harbour

313 grandiflora (Hook.) Nutt.

Hamilton

diffusa (Vahl) Gray

Hansen

1380 californica (T. & G.) Gray

Harper

1743 cordifolia Ell.

Hartman

325 amplexicaulis Robinson
333 " "
775 Lemmoni Gray
782 Rusbyi Gray
787 simplex Gray
908 Coulteri Gray

Hartweg

138 scoparia (DC.) Gray
598 paniculata (Mill.) Robinson
1768 californica (T. & G.) Gray

Hasse

californica (T. & G.) Gray

Havard

9 conduplicata Robinson ad cylindraceam, v. laxam Grayi transiens
67 brachyphylla Gray
1301 laciniata Gray
californica (T. & G.) Gray
laciniata Gray

Hayes

349 frutescens Gray

Heermann

californica (T. & G.) Gray

Heller

8638 oblongifolia Nutt.
10,606 oblongifolia, v. linifolia (D. C. Eaton) Robinson
10,993 oblongifolia Nutt.

Henderson

3219 oblongifolia Nutt. ad v. linifoliam (D. C. Eaton) Robinson transiens
3656 grandiflora (Hook.) Nutt.
4824 oblongifolia Nutt.
grandiflora (Hook.) Nutt.

Herrick

780 brachyphylla Gray

Heyde & Lux (distrib. J. D. Sm.)

4198 diffusa (Vahl) Gray
4201 partim adenocarpa Robinson, partim adenocarpa, v. glandulipes Robinson
4218 pacayensis Coult.

Hillman

microphylla (Nutt.) Gray
oblongifolia Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Hinds

hastata Benth

Hitchcock, A. E.

1470 grandiflora (Hook.) Nutt.

Holway

92 adenocarpa, v. glandulipes Robinson
151 adenocarpa Robinson
466 " "
3686 veronicaefolia (HBK.) Gray
3767 tomentella Gray
5003 grandiflora (Hook.) Nutt.
5022 megalodonta Greenman
5249 secundiflora (Lag.) Gray

Holzinger

brachyphylla Gray

Holzner

2009 simplex Gray

Hooker f. & Gray

californica (T. & G.) Gray

Horner, C. N. S.

grandiflora (Hook.) Nutt.

Horner, R. M.

247 grandiflora (Hook.) Nutt.
248 oblongifolia Nutt.
R351B247 grandiflora (Hook.) Nutt.
R354B248 oblongifolia Nutt.

Houston

paniculata (Mill.) Robinson

Howell

739 Greenei Gray
1168 " "
grandiflora (Hook.) Nutt.
Greenei Gray
oblongifolia Nutt.

Hugo & Conzatti

2489 pacayensis Coult.

Humboldt & Bonpland

4233 secundiflora, v. nepetaefolia (HBK.) Robinson
4374 nutans (HBK.) Robinson
veronicaefolia (HBK.) Gray

Jepson

californica (T. & G.) Gray
californica, v. Jepsonii Robinson
californica (T. & G.) Gray, ad v. Jepsonii Robinson transiens

Jermy

49 cylindracea Gray & Engelm.

Johnston, E. L.

715 grandiflora (Hook.) Nutt.

Jones

287 veronicaefolia, v. petrophila Robinson
290 (12,042) Palmeri, v. amphothrix Robinson
290 (12,043) spinulosa Gray
685 grandiflora (Hook.) Nutt.
770 californica (T. & G.) Gray
1269 grandiflora (Hook.) Nutt.
1467 Watsonii Robinson
1830 oblongifolia, v. linifolia (D. C. Eaton) Robinson
1830a oblongifolia, v. linifolia (D. C. Eaton) Robinson
1921 californica (T. & G.) Gray
3917 atractyloides Gray
4091 grandiflora (Hook.) Nutt.
4326 californica (T. & G.) Gray
4501 floribunda Gray
5069p atractyloides Gray
5077l desertorum Coville
5095p californica (T. & G.) Gray ?
5110s atractyloides Gray
5289o oblongifolia, v. linifolia (D. C. Eaton) Robinson
5463 oblongifolia, v. linifolia (D. C. Eaton) Robinson
5476h oblongifolia, v. linifolia (D. C. Eaton) Robinson
5663ah oblongifolia, v. linifolia (D. C. Eaton) Robinson
5663y californica (T. & G.) Gray
5663z scabra (Gray) Nels.
5701b " " "
5972 Watsonii Robinson
5986 californica (T. & G.) Gray
5989j oblongifolia, v. linifolia (D. C. Eaton) Robinson
5992 grandiflora (Hook.) Nutt.
6047e scabra (Gray) Nels.
6066e californica (T. & G.) Gray
6066f " " "
6080g scabra (Gray) Nels.
6081 longifolia Wats.
11,997 desertorum Coville.
12,039 " "
12,050 scabra (Gray) Nels. ?
amplexicaulis Robinson
arguta Robinson
atractyloides Gray
californica (T. & G.) Gray
californica, v. tenera (Gray) Robinson
Coulteri Gray
desertorum Coville
Fendleri Gray
floribunda Gray

frutescens Gray
grandiflora (Hook.) Nutt.
Lemmoni Gray
Lemmoni, v. Wootoni (Greene) Robinson
longifolia Wats.
oblongifolia Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson
Rusbyi Gray
scabra (Gray) Nels.
simplex Gray
venosa (Wooton & Standley) Robinson
Watsonii Robinson

Kellerman

4574 adenocarpa Robinson
4750 paniculata (Mill.) Robinson
4769 adenocarpa Robinson
5333 pro parte adenocarpa, v. glandulipes Robinson
6127 Kellermanii Greenman

Kellogg

multiflora Kellogg

Kellogg & Harford

361 californica (T. & G.) Gray

Kennedy

1827 atractyloides Gray
1954 microphylla (Nutt.) Gray

King

californica (T. & G.) Gray

Kirkwood

15 veronicaefolia (HBK.) Gray

Knapp

Knappiana Drew

Knowlton, F. H.

7 grandiflora (Hook.) Nutt.

Kreager

542 grandiflora (Hook.) Nutt.
547 " " "

Kuntze

32B californica (T. & G.) Gray
692 diffusa (Vahl) Gray
1206 diffusa (Vahl) Gray
3060 grandiflora (Hook.) Nutt.
diffusa (Vahl) Gray

Lamson-Scribner

71 grandiflora (Hook.) Nutt.

Langlassé

58 squarrosa (Cav.) Robinson
61 pacayensis Coult.
682 filipes Robinson
760 glomerata Fernald
856 squarrosa (Cav.) Robinson

Lehmann

B. T. 1116 diffusa (Vahl) Gray

Leiberg

802 oblongifolia Nutt.
955 " "
5103 Greenei Gray
5350 grandiflora (Hook.) Nutt.
5385 californica (T. & G.) Gray
5801 grandiflora (Hook.) Nutt.

Lemmon

21 oblongifolia, v. linifolia (D. C. Eaton) Robinson
29 oblongifolia, v. linifolia (D. C. Eaton) Robinson
35 oblongifolia, v. linifolia (D. C. Eaton) Robinson
39 grandiflora (Hook.) Nutt.
60 californica, v. tenera (Gray) Robinson
72 Coulteri Gray
73 floribunda Gray
74 " "
87 grandiflora (Hook.) Nutt.
104 scoparia (DC.) Gray
116 microphylla (Nutt.) Gray
193 Coulteri Gray
305 simplex Gray
306 Lemmoni Gray
308 venosa (Wooton & Standley) Robinson
309 grandiflora, v. petiolaris Gray
310 simplex Gray
311 grandiflora, v. petiolaris Gray
312 Fendleri Gray
313 betonicaefolia Gray
314 brachyphylla Gray

315 californica (T. & G.) Gray
317 Rusbyi Gray
326 floribunda Gray
327 betonicaefolia Gray
364 venosa (Wooton & Standley) Robinson
365 floribunda Gray
366 grandiflora, v. petiolaris Gray
1101 grandiflora (Hook.) Nutt.
1107 microphylla (Nutt.) Gray
1263 oblongifolia, v. linifolia (D. C. Eaton) Robinson
1483 oblongifolia, v. linifolia (D. C. Eaton) Robinson
2735 Rusbyi Gray
2736 grandiflora, v. petiolaris Gray
2737 Pringlei Gray
2740 squamulosa Gray
3323 oblongifolia, v. linifolia (D. C. Eaton) Robinson
atractyloides Gray
Lemmoni Gray
verbenacea (Greene) Robinson ?

Letterman

californica (T. & G.) Gray
grandiflora (Hook.) Nutt.

Lévy

438 diffusa (Vahl) Gray
1334 paniculata (Mill.) Robinson

Liebmann

119 diffusa (Vahl) Gray
236 scoparia (DC.) Gray
339 glomerata Fernald
342 veronicaefolia (HBK.) Gray
345 oliganthes (Less.) Gray
347 " " "
349 " " "

Lindheimer

7 cylindracea Gray & Engelm.
191 dentata (DC.) Sch. Bip.
409 " " " "
412 cylindracea Gray & Engelm.
438 dentata (DC.) Sch. Bip.
439 cylindracea Gray & Engelm.
467 " "
889 " "
890 dentata (DC.) Sch. Bip.
891 " " " "

Lloyd

9 laciniata Gray
34 " "
421 floribunda Gray
422 Rusbyi Gray

Lloyd & Earle

cordifolia Ell.

Lloyd & Kirkwood

49 veronicaefolia (HBK.) Gray

Lockhart

diffusa (Vahl) Gray

Loew

betonicaefolia Gray

Lowell

californica (T. & G.) Gray

Lyall

oblongifolia Nutt.

Macbride

348 oblongifolia Nutt.

McClatchie

californica (T. & G.) Gray
Nevinii Gray

MacDougal

365 partim grandiflora (Hook.) Nutt., partim grandiflora, v. petiolaris Gray

Macoun, J. M.

76,963 oblongifolia Nutt.

McVay

1185 squamulosa Gray

Maltby

Coulteri Gray

Martius

783 brasiliensis (Spreng.) Robinson

Mearns

180 californica (T. & G.) Gray
233 grandiflora, v. petiolaris Gray
1002 Rusbyi Gray
1008 venosa (Wooton & Standley) Robinson

1011 californica (T. & G.) Gray
1035 floribunda Gray
1041 " "
1058 venosa (Wooton & Standley) Robinson
1089 floribunda Gray
2211 Lemmoni Gray
2234 " "
2252 grandiflora, v. petiolaris Gray
2344 floribunda Gray
2430 grandiflora, v. petiolaris Gray
2468 floribunda Gray
2594 grandiflora (Hook.) Nutt.
2609 Rusbyi Gray
2611 grandiflora (Hook.) Nutt.
2682 baccharidea Gray
3846 californica (T. & G.) Gray

Meehan

grandiflora (Hook.) Nutt.

Mendez

corymbosa (DC.) Gray
lanata (DC.) Gray
scoparia (DC.) Gray

Merrill

397 oblongifolia Nutt.

Metcalfe

358 Fendleri Gray
387 brachyphylla Gray
635 californica (T. & G.) Gray
653 venosa (Wooton & Standley) Robinson
733 brachyphylla Gray
776 chenopodina (Greene) Robinson
1183 Fendleri Gray
1376 betonicaefolia Gray
1381 partim grandiflora (Hook.) Nutt., partim grandiflora, v. petiolaris Gray
1401 brachyphylla Gray
1446 californica, v. tenera (Gray) Robinson
1455 Rusbyi Gray
1474 floribunda Gray
1509 Lemmoni, v. Wootoni (Greene) Robinson

Mex. Bound. Surv.

460 laciniata Gray
460a Coulteri Gray
461b venosa (Wooton & Standley) Robinson
462 dentata (DC.) Sch. Bip.
463 cylindracea Gray & Engelm.
465 grandiflora (Hook.) Nutt.

Michener & Bioletti

californica (T. & G.) Gray

Minthorn

microphylla (Nutt.) Gray

Monnet

frutescens Gray
scabra (Gray)Nels.

Mueller

299 veronicaefolia (HBK.) Gray
1293 orizabensis Klatt

Mulford

822 californica (T. & G.) Gray
1142 californica, v. tenera (Gray) Robinson
grandiflora (Hook.) Nutt.
laciniata Gray

Nash

2554 cordifolia Ell.

Nealley

199 grandiflora (Hook.) Nutt.
200 Rusbyi Gray
434 laciniata Gray

Née

hebecarpa (DC.) Gray

Nelson, A.

423 grandiflora (Hook.) Nutt.
1687 " " "
4212 " " "
7506 " " "
8766 " " "

Nelson & Macbride

1163 oblongifolia Nutt.
2220 " "

Nelson, A. & Nelson, E.

6420 grandiflora (Hook.) Nutt.

Nelson, E. W.

124 atractyloides Gray
1546 veronicaefolia (HBK.) Gray
1556 secundiflora (Lag.) Gray

1871 diffusa (Vahl) Gray
1926 veronicaefolia (HBK.) Gray
2002 Coulteri Gray
2100 scoparia (DC.) Gray
2171 paniculata (Mill.) Robinson
2175 oliganthes (Less.) Gray
2218 orizabensis Klatt
2391 glomerata Fernald
2411 paniculata (Mill.) Robinson
3529 " " "
4089 squarrosa (Cav.) Robinson
4130 paniculata (Mill.) Robinson
4449 Nelsonii Robinson
4955 odontophylla Gray
5008 Wislizeni Gray
6222 simplex Gray
6438 laciniata Gray
6475 amplexicaulis Robinson
6477 californica (T. & G.) Gray
6491 amplexicaulis Robinson
6502 Lemmoni, v. Wootoni (Greene) Robinson
6842 pacayensis Coult.
6875 squarrosa (Cav.) Robinson
6954 pacayensis Coult.
7009 filipes Robinson

Nevin

Nevinii Gray

Norton

grandiflora (Hook.) Nutt.

Nuttall

grandiflora (Hook.) Nutt.
microphylla (Nutt.) Gray
oblongifolia Nutt.

Oersted

diffusa (Vahl) Gray
paniculata (Mill.) Robinson

d'Orbigny

558 paucidentata Klatt (sp. valde dubitativa)

Orcutt

112 californica (T. & G.) Gray
1101 arguta Robinson
1121 frutescens Gray
1250A californica (T. & G.) Gray
1252 grandiflora, v. petiolaris Gray
1464 desertorum Coville
3066 diffusa (Vahl) Gray
5124 Parryi Gray
5435 veronicaefolia, v. petrophila Robinson
arguta, v. odontolepis Robinson
californica (T. & G.) Gray
desertorum Coville

Osgood

longifolia Wats.

Osterhout

2411 californica (T. & G.) Gray
2414 grandiflora (Hook.) Nutt.
3155 californica (T. & G.) Gray
3400 scabra (Gray) Nels.
4608 californica (T. & G.) Gray

Pace

469 grandiflora (Hook.) Nutt.

Palmer, E.

(annis ob duplicationem numerorum nonnullam etiam indicatis)

1 ('96) squamulosa Gray
11 ('06) vernicosa Robinson
13 ('08) spinulosa Gray
19 ('69 Coulteri Gray
53 ('06) squarrosa (Cav.) Robinson
57 ('96) vernicosa Robinson
59 ('86) oliganthes (Less.) Gray
60 ('96) verbenacea (Greene) Robinson
60 ('08) squamulosa Gray
62 ('87) Coulteri Gray
78 ('04) conduplicata Robinson
125 ('75) californica (T. & G.) Gray
148 ('96) spinulosa Gray
148 ('02) Parryi, v. micacea Robinson
162 ('07) diffusa (Vahl) Gray
166 ('85) " " "
168 ('76) oblongifolia, v. linifolia (D. C. Eaton) Robinson
169 ('85) brachiata Gray
171 ('75) californica (T. & G.) Gray
191 ('75) frutescens Gray
191 ('77) atractyloides Gray
192 ('77) oblongifolia, v. linifolia (D. C. Eaton) Robinson
269 ('90) glabrata (Rose) Robinson

279 ('98) Coulteri Gray
281 ('96) Wislizeni Gray
286 ('90) Pringlei Gray
291 ('98) veronicaefolia (HBK.) Gray
320 ('98) laciniata Gray
322 ('87) rhomboidea Greene
323 ('87) " "
360 ('06) monocephala Robinson
434 ('85) betonicaefolia Gray
435 ('85) " "
436 ('85) simplex Gray
438 ('98) veronicaefolia, v. umbratilis Robinson
442 ('80) odontophylla Gray
445 ('79–'80) cylindracea, v. laxa Gray
446 ('79–'80) " " " "
448 ('79) dentata (DC.) Sch. Bip.
449 ('80) " " " "
450 ('80) laciniata Gray
450 ('86) lanata (DC.) Gray
451 ('80) Coulteri Gray
485 ('86) secundiflora, v. nepetaefolia (HBK.) Robinson
497 ('94–'95) glomerata Fernald
505 ('96) Wislizeni Gray
518 ('06) " "
521 ('98) veronicaefolia, v. umbratilis Robinson
528 ('93) microphylla (Nutt.) Gray
583 ('98) veronicaefolia (HBK.) Gray
585 ('98) " " "
586 ('98) " " "
601 ('86) scoparia (DC.) Gray
610 ('76) Coulteri Gray
647 ('96) Palmeri, v. amphothrix Robinson
652 ('86) cuspidata Gray
753 ('96) veronicaefolia, v. petrophila Robinson
758 ('86) scoparia (DC.) Gray
812 ('90) Coulteri Gray
818 ('96) squamulosa Gray
840 ('96) solidaginifolia Gray
849 ('90) glabrata (Rose) Robinson
947 ('90) Coulteri Gray
1077 ('78–'79) scoparia, v. subauriculata Robinson
1078 ('78–'79) laciniata Gray
1086 ('78–'79) diffusa (Vahl) Gray
1087 ('78–'79) partim Nelsonii Robinson, partim secundiflora (Lag.) Gray
1149 ('91) lanata, v. microdonta Robinson
1160 ('91) hebecarpa (DC.) Gray
1188 ('91) diffusa (Vahl) Gray
1727 ('91) Coulteri Gray
2079 ('80) Palmeri, v. amphothrix Robinson
('69) californica (T. & G.) Gray
('70, '74, '75) atractyloides Gray
('75) californica (T. & G.) Gray
('75) longifolia Wats.
('76) oblongifolia, v. linifolia (D. C. Eaton) Robinson
('77) oblongifolia, v. linifolia (D. C. Eaton) Robinson
('92) paniculata (Mill.) Robinson
('92) Pringlei Gray

Palmer, E. J.

4488 grandiflora (Hook.) Nutt.
4523 " " "
4713 " " "
4731 " " "

Parish fratres

(singillatim vel conjunctim)

88 Coulteri Gray
89 Pringlei Gray
566 californica (T. & G.) Gray
1210 arguta Robinson
1210B arguta Robinson
1247 oblongifolia, v. linifolia (D. C. Eaton) Robinson
1247* oblongifolia, v. linifolia (D. C. Eaton) Robinson
1248 incana Gray
1390 frutescens Gray
2387 incana Gray
2387(bis) arguta Robinson
2388 incana Gray
3181 oblongifolia, v. linifolia (D. C. Eaton) Robinson
3710 arguta Robinson
3711 oblongifolia, v. linifolia (D. C. Eaton) Robinson
4875 arguta Robinson
10,123 " "
10,242 incana Gray
Coulteri Gray

oblongifolia, v. linifolia (D. C. Eaton) Robinson

Parry

0 desertorum Coville
1 incana Gray
37 Watsonii Robinson
89 oblongifolia, v. linifolia (D. C. Eaton) Robinson
90 atractyloides Gray
358 Coulteri Gray
423 grandiflora (Hook.) Nutt.
grandiflora (Hook.) Nutt.
incana Gray

Parry & Lemmon

158 arguta Robinson

Parry & Palmer

349 hymenochlaena Gray
350 Parryi Gray
351 veronicaefolia, v. petrophila Robinson
354 Palmeri Gray
355 verbenacea (Greene) Robinson
356 squamulosa Gray
357 spinulosa Gray
358 Coulteri Gray
362 thyrsiflora Gray
363 Parryi Gray
363½ secundiflora (Lag.) Gray
375 thyrsiflora Gray

Patterson

221 grandiflora (Hook.) Nutt.
californica (T. & G.) Gray

Patzky

squamulosa Gray

Payson

482 oblongifolia, v. linifolia (D. C. Eaton) Robinson
594 scabra (Gray) Nels.

Phillips & Sargent

californica (T. & G.) Gray

Pilsbry

californica (T. & G.) Gray
longifolia Wats.

Piper

2381 grandiflora (Hook.) Nutt.
2745 oblongifolia Nutt.
oblongifolia Nutt.

Pittier

1980 argyrolepis Robinson
3277 diffusa (Vahl) Gray
4928 " " "
10,624 " " "

Plummer

grandiflora (Hook.) Nutt.

Pohl

369 brasiliensis (Spreng.) Robinson
624 diffusa (Vahl) Gray

Popenoe

grandiflora (Hook.) Nutt.

Pringle

96 Coulteri Gray
112 venosa (Wooton & Standley) Robinson
143 glutinosa Gray
181 Palmeri, v. amphothrix Robinson
210 spinulosa, v. asperata Robinson
240 Palmeri, v. amphothrix Robinson
323 Wislizeni Gray
350 venosa (Wooton & Standley) Robinson
605 californica (T. & G.) Gray
606 floribunda Gray
609 amplexicaulis Robinson
610 veronicaefolia, v. petrophila Robinson
628 laciniata Gray
635 Lemmoni, v. Wootoni (Greene) Robinson
641 simplex Gray
705 squamulosa Gray
744 solidaginifolia Gray
924 californica (T. & G.) Gray
925 Wislizeni Gray
934 floribunda Gray
945 amplexicaulis Robinson
946 veronicaefolia, v. petrophila Robinson
947 Lemmoni, v. Wootoni (Greene) Robinson
971 laciniata Gray
1021 venosa (Wooton & Standley) Robinson
1070 simplex Gray

1267 betonicaefolia Gray
1268 Rusbyi Gray
1593 spinulosa Gray
1621 betonicaefolia Gray
1622 Rusbyi Gray
1751 Palmeri, v. amphothrix Robinson
1757 lanata Gray
1766 scoparia, v. subauriculata Robinson
1790 secundiflora, v. nepetaefolia (HBK.) Robinson
1792 paniculata (Mill.) Robinson
1855 cuspidata Gray
1856 partim oliganthes (Less.) Gray, partim verbenacea (Greene) Robinson
2159 scoparia (DC.) Gray
2174 diffusa (Vahl) Gray
2325 scoparia (DC.) Gray
2724 cuspidata Gray
3171 conduplicata Robinson
3504 Coulteri Gray
3932 " "
4698 hymenochlaena Gray
5054 pendula, v. squarrosa (Robinson & Seaton) Robinson
5055 nutans (HBK.) Robinson
5080 sp. dubia an nova sed specimen ut videtur vix normale
5369 diffusa (Vahl) Gray
5697 pendula (Schrad.) Gray
5885a cardiophylla Robinson
5944 veronicaefolia (HBK.) Gray
6032 diffusa (Vahl) Gray
6109 lancifolia Robinson & Greenman
6114 orizabensis Klatt
6167 pendula (Schrad.) Gray
6172 tomentella Gray
6268 paniculata (Mill.) Robinson
6804 pacayensis Coult.
7020 squarrosa (Cav.) Robinson
7332 pacayensis Coult.
7350 nutans (HBK.) Robinson
8016 pendula (Schrad.) Gray
8059 partim nutans (HBK.) Robinson, partim pendula (Schrad.) Gray
8415 amblyolepis Robinson
8495 cardiophylla Robinson
8563 veronicaefolia (HBK.) Gray, v. senilis Robinson
8621 monocephala Robinson
8753 pulcherrima Robinson
8912 Nelsonii Robinson
9462 paniculata (Mill.) Robinson
9862 secundiflora (Lag.) Gray
9863 scoparia (DC.) Gray
9864 cuspidata Gray
9866 paniculata (Mill.) Robinson
9867 veronicaefolia (HBK.) Gray
10,081 conduplicata Robinson
10,082 saltillensis Robinson
10,101 odontophylla Gray
10,102 betonicaefolia, v. elliptica Robinson
10,403 glomerata Fernald
11,336 pulcherrima Robinson
11,492 secundiflora, v. nepetaefolia (HBK.) Robinson
11,493 scoparia (DC.) Gray
11,494 cuspidata Gray
11,495 lanata (DC.) Gray
11,496 nutans (HBK.) Robinson
11,909 oliganthes (Less.) Gray
13,034 laciniata Gray
13,035 monocephala Robinson
13,536 Coulteri Gray
13,537 solidaginifolia Gray
13,538 secundiflora (Lag.) Gray
13,539 floribunda Gray
13,540 paniculata (Mill.) Robinson
13,541 veronicaefolia, v. petrophila Robinson
13,542 Wislizeni Gray
13,543 californica, v. lobulata Robinson
13,666 solidaginifolia Gray
13,669 Palmeri, v. amphothrix Robinson
amblyolepis Robinson
brachyphylla Gray
californica (T. & G.) Gray
Coulteri Gray
floribunda Gray
Pringlei Gray

Purpus

41 pendula (Schrad.) Gray
52 pro parte glabrata (Rose) Robinson (cum Hofmeisteria laphamioide Rosei commixta)
193 oblongifolia, v. linifolia (D. C. Eaton) Robinson
347 grandiflora (Hook.) Nutt.

441 Coulteri Gray
484 veronicaefolia, v. petrophila Robinson
485 peninsularis Brandegee
492 lanata, v. microdonta Robinson
501 veronicaefolia, v. petrophila Robinson
503 " " " "
1014 Coulteri Gray
1253 californica (T. & G.) Gray
1559 nutans (HBK.) Robinson
1560 tomentella Gray
1561 pendula (Schrad.) Gray
1857 ('06) pacayensis Coult.
1857 ('07) paniculata (Mill.) Robinson
1858 oliganthes (Less.) Gray
1920 oblongifolia, v. linifolia (D. C. Eaton) Robinson
2191 diffusa (Vahl) Gray
2634 tomentella Gray
2793 veronicaefolia (HBK.) Gray, v. senilis Robinson
3050 multiflora Kellogg
3141 hymenochlaena Gray
3653 pacayensis Coult.
3846 hymenochlaena Gray
4461 Coulteri Gray
4567 " "
4650 veronicaefolia (HBK.) Gray
4713 conduplicata Robinson
4714 laciniata Gray
4716 cylindracea Gray & Engelm.
4725 " "
4728 " "
4802 cymulifera Robinson
4824 conduplicata Robinson
4825 veronicaefolia (HBK.) Gray
4826 scoparia (DC.) Gray
5127 conduplicata Robinson
5252 oliganthes (Less.) Gray
5356 oblongifolia, v. linifolia (D. C. Eaton) Robinson
5612 veronicaefolia (HBK.) Gray
5951 oblongifolia, v. linifolia (D. C. Eaton) Robinson
6041 incana Gray
6286 Watsonii Robinson
6426 microphylla (Nutt.) Gray
6448 grandiflora, v. petiolaris Gray
6475 oblongifolia, v. linifolia (D. C. Eaton) Robinson
7031 californica (T. & G.) Gray
7276 peninsularis Brandegee
7276b " "
8503 Coulteri Gray
Coulteri Gray
frutescens Gray

Regnell

III. 698 brasiliensis (Spreng.) Robinson

Rehder

48 californica (T. & G.) Gray
273 " " "
342 Rusbyi Gray

Riddell

dentata (DC.) Sch. Bip.

Riedel

834 brasiliensis (Spreng.) Robinson
1001 diffusa (Vahl) Gray
1511 brasiliensis (Spreng.) Robinson
1527 diffusa (Vahl) Gray
1945 brasiliensis (Spreng.) Robinson
2406 diffusa (Vahl) Gray

Robbins

6982 scabra (Gray) Nels.
8207 Fendleri Gray

Rose

249 grandiflora (Hook.) Nutt.
1289 Coulteri Gray
2842 lanata (DC.) Gray
16,343 Coulteri Gray
16,449 " "
16,693 macromera Robinson

Rose & Fitch

17,514 californica (T. & G.) Gray
17,593 " " "

Rose, Fitch & Parkhurst

17,729 Fendleri Gray

Rose, Fitch & Russell

4202 diffusa (Vahl) Gray

Rose & Hay

5319 hebecarpa (DC.) Gray

Rose & Painter

7631 lanata (DC.) Gray
7763 veronicaefolia, v. petrophila Robinson
7840 secundiflora (Lag.) Gray

Rose, J. N. & Rose, J. S.

11,438 veronicaefolia (HBK.) Gray

Rose, Standley & Russell

12,345 Coulteri Gray
12,798 amplexicaulis Robinson
13,054 Coulteri Gray
13,374 brachiata, v. adenopoda Robinson
13,558 Coulteri Gray
14,202 diffusa (Vahl) Gray
14,337 hebecarpa (DC.) Gray
Coulteri Gray

Rothrock

793 floribunda Gray

Rovirosa

907 scoparia (DC.) Gray

Rugel

cordifolia Ell.

Rusby

237 grandiflora (Hook.) Nutt.
238 partim californica (T. & G.) Gray, partim floribunda Gray
238½ grandiflora, v. petiolaris Gray
239 floribunda Gray
239½ grandiflora, v. petiolaris Gray
240 Fendleri Gray
240½ brachyphylla Gray
241 betonicaefolia Gray
241½ Rusbyi Gray
californica (T. & G.) Gray
grandiflora (Hook.) Nutt.
venosa (Wooton & Standley) Robinson

Rydberg

137 grandiflora (Hook.) Nutt.
187 " " "
californica (T. & G.) Gray
grandiflora (Hook.) Nutt.

Rydberg & Carlton

6954 oblongifolia, v. linifolia (D. C. Eaton) Robinson
6955 oblongifolia, v. linifolia (D. C. Eaton) Robinson
6974 oblongifolia, v. linifolia (D. C. Eaton) Robinson
7575 grandiflora (Hook.) Nutt.

Rydberg & Garrett

8351 scabra (Gray) Nels.
8419 " " "
8535 oblongifolia, v. linifolia (D. C. Eaton) Robinson
9612 grandiflora (Hook.) Nutt.
9689 " " "
9880 oblongifolia, v. linifolia (D. C. Eaton) Robinson
9881 scabra (Gray) Nels.
10,004 californica (T. & G.) Gray

de la Sagra

diffusa (Vahl) Gray

Salvin

paniculata (Mill.) Robinson

Sandberg

4292 grandiflora (Hook.) Nutt.
oblongifolia Nutt.

Sandberg & Leiberg

408 oblongifolia Nutt.
491 " "
6237 " "
7037 " "
oblongifolia Nutt.

Sandberg, MacDougal & Heller

749 grandiflora (Hook.) Nutt.
911 oblongifolia Nutt.

Sanders

californica (T. & G.) Gray

Sargent

californica (T. & G.) Gray

Sartorius

diffusa (Vahl) Gray
oliganthes (Less.) Gray

Savage, Cameron & Lenocker

7 grandiflora (Hook.) Nutt.

Schaffner

22 secundiflora (Lag.) Gray
31 veronicaefolia (HBK.) Gray
256 hymenochlaena Gray
290 thyrsiflora Gray
363 spinulosa Gray
364 squamulosa Gray
365 pro parte secundiflora v. nepetaefolia (HBK.) Robinson
366 veronicaefolia, v. petrophila Robinson
367 Palmeri Gray
368 verbenacea (Greene) Robinson
694 hymenochlaena Gray
721 thyrsiflora Gray
787 spinulosa Gray
788 squamulosa Gray
789 " "
790 spinulosa Gray
793 veronicaefolia, v. petrophila Robinson
794 Palmeri Gray
795 verbenacea (Greene) Robinson
798 squamulosa Gray
diffusa (Vahl) Gray
nutans (HBK.) Robinson
tomentella Gray

Schellenger

98 incana Gray

Scheuber

37 grandiflora (Hook.) Nutt.
grandiflora (Hook.) Nutt.

Schiede

1539 squarrosa (Cav.) Robinson
paniculata (Mill.) Robinson
pendula (Schrad.) Gray
veronicaefolia (HBK.) Gray

Schiede & Deppe

293 oliganthes (Less.) Gray

Schoenfeldt

3846 californica (T. & G.) Gray

Schott

Comp. 24 veronicaefolia, v. petrophila Robinson

Schuchort

grandiflora (Hook.) Nutt.

Schumann, W.

59 secundiflora (Lag.) Gray
145 squamulosa Gray

Searles

oblongifolia, v. linifolia (D. C. Eaton) Robinson

Seemann

1584 diffusa (Vahl) Gray
2008 scoparia (DC.) Gray
2025 oliganthes (Less.) Gray
2035 laciniata Gray
amplexicaulis Robinson
oliganthes (Less.) Gray
Seemanni Gray

Seler, C. & E.

618 diffusa (Vahl) Gray
1066 scoparia (DC.) Gray
1324 veronicaefolia (HBK.) Gray
1370 " " "
1371 paniculata (Mill.) Robinson
1389 " " "
1655 glomerata Fernald
1732 paniculata (Mill.) Robinson
1765 glomerata Fernald
1766 paniculata (Mill.) Robinson
1925 diffusa (Vahl) Gray
2129 adenocarpa, v. glandulipes Robinson (specimen defectivum et dubium)

Sello

brasiliensis (Spreng.) Robinson

Shear

3261 californica (T. & G.) Gray
3264 grandiflora (Hook.) Nutt.
3776 " " "
4589 californica (T. & G.) Gray

Shear & Bessey

3929 grandiflora (Hook.) Nutt.

Sheldon, C. S.

51 grandiflora (Hook.) Nutt.
455 " " "
californica (T. & G.) Gray

Shepherd

veronicaefolia (HBK.) Gray

Shockley

309 microphylla (Nutt.) Gray
551 multiflora Kellogg

Skehan

77 californica (T. & G.) Gray
105 Fendleri Gray

Skinner

paniculata (Mill.) Robinson
scoparia (DC.) Gray

Smart

271 Coulteri Gray

Smith, B. H.

grandiflora (Hook.) Nutt.

Smith, C. L.

304 scoparia (DC.) Gray
375 tomentella Gray
382 veronicaefolia (HBK.) Gray
383 pendula (Schrad.) Gray
387 " " "
581 diffusa (Vahl) Gray

Smith, E. A.

cordifolia Ell.

Smith, H. G., Jr.

grandiflora (Hook.) Nutt.

Smith, H. H.

622 diffusa (Vahl) Gray

Smith, J. D.

2386 diffusa (Vahl) Gray
2389 pacayensis Coult.
2402 maxima pro parte adenocarpa Robinson, minima pro parte adenocarpa, v. glandulipes Robinson
4859 argyrolepis Robinson

Smith, L. C.

198 pacayensis Coult.
378 adenocarpa Robinson
482 hymenochlaena Gray
883 scoparia (DC.) Gray
925 veronicaefolia (HBK.) Gray

Snodgrass & Heller

51 diffusa (Vahl) Gray
72 " " "
93 " " "
214 " " "

Snow

Fendleri Gray

Standley

4559 Fendleri Gray
5189 " "
6082 brachyphylla Gray
7122 scabra (Gray) Nels.
7354 " " "
7517 californica (T. & G.) Gray
7692 grandiflora (Hook.) Nutt.
8219 brachyphylla Gray
8232 grandiflora (Hook.) Nutt.
californica (T. & G.) Gray

Standley & Bollman

10,650 Fendleri Gray
10,666 grandiflora (Hook.) Nutt.
10,955 Rusbyi Gray (f. foliis longis tenuibus rhombeis)
11,066 grandiflora (Hook.) Nutt.

Stearns

247 Coulteri Gray

Stewart

756 diffusa (Vahl) Gray
757 " " "
758 " " "

Stokes

oblongifolia Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Stone

28 squarrosa (Cav.) Robinson

Tate

tomentella Gray

Thieme (distrib. J. D. Sm.)

5317 diffusa (Vahl) Gray

Thompson

longifolia Wats.

Thornber

95 floribunda Gray
115 californica (T. & G.) Gray
361 Coulteri Gray
464 " "

Thurber

831 laciniata Gray
931 californica (T. & G.) Gray
938 venosa (Wooton & Standley) Robinson
1004 betonicaefolia Gray
1011 simplex Gray
simplex Gray
veronicaefolia (HBK.) Gray

Tidestrom

559 Watsonii Robinson

Tonduz

4928 diffusa (Vahl) Gray
7710 argyrolepis Robinson
7762 " "
11,847 " "
13,604 diffusa (Vahl) Gray
17,465 argyrolepis Robinson

Torrey

199 microphylla (Nutt.) Gray
200 californica (T. & G.) Gray
grandiflora, ad v. petiolarem Grayi varians

Toumey

3 californica (T. & G.) Gray
4 grandiflora (Hook.) Nutt.
23 squamulosa Gray
669 betonicaefolia Gray
670a Coulteri Gray
670b " "
californica (T. & G.) Gray
Coulteri Gray

Townsend & Barber

280 simplex Gray
348 betonicaefolia Gray
362 Rusbyi Gray
420 simplex Gray

Tracy, J. P.

960 californica (T. & G.) Gray, ad v. Jepsonii Robinson transiens
4674 californica (T. & G.) Gray

Tracy & Evans

707 grandiflora (Hook.) Nutt.
709 californica (T. & G.) Gray
858 grandiflora (Hook.) Nutt.

Trask

californica (T. & G.) Gray

Trelease

591 grandiflora (Hook.) Nutt.

Triana

1176 diffusa (Vahl) Gray

von Tuerckheim

II. 2145 guatemalensis Robinson
II. 2265 diffusa (Vahl) Gray

Tweedy

217 oblongifolia Nutt.
322 grandiflora (Hook.) Nutt.
517 " " "
4023 " " "
4942 " " "
oblongifolia Nutt.

Umbach

486 grandiflora (Hook.) Nutt.
807 " " "

Underwood & Selby

14 grandiflora (Hook.) Nutt.

Vasey, G.

322 grandiflora (Hook.) Nutt.

Vasey, G. R.

249 frutescens Gray
541 oblongifolia Nutt.
Coulteri Gray
frutescens Gray
grandiflora (Hook.) Nutt.
Rusbyi Gray

Vauthier

314 coridifolia (DC.) Robinson

Veatch

microphylla (Nutt.) Gray

Velasco (distrib. J. D. Sm.)

8900 pacayensis Coult.

Vischer

81 tomentella Gray

Wagner, F.

1141 californica, v. tenera (Gray) Robinson

Walker

123 oblongifolia, v. linifolia (D. C. Eaton) Robinson
445 grandiflora (Hook.) Nutt.

Ward

123 californica (T. & G.) Gray
californica (T. & G.) Gray
grandiflora (Hook.) Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson
Parryi Gray

Warming

diffusa (Vahl) Gray

Watson

178 grandiflora (Hook.) Nutt.
492 oblongifolia, v. abbreviata Gray
493 oblongifolia, v. linifolia (D. C. Eaton) Robinson
494 Watsonii Robinson
495 californica (T. & G.) Gray
496 grandiflora (Hook.) Nutt.
oblongifolia, v. linifolia (D. C. Eaton) Robinson

Wheeler

longifolia Wats.

Whited

574 oblongifolia Nutt.
690 " "

Wilcox

253 squamulosa Gray
410 " "
434 betonicaefolia Gray
471 simplex Gray
microphylla (Nutt.) Gray

Wilkes Exped.

540 oblongifolia Nutt.
1614 californica (T. & G.) Gray
oblongifolia Nutt.

Wilkinson

floribunda Gray
laciniata Gray
veronicaefolia, v. petrophila Robinson

Williams, R. S.

223 grandiflora (Hook.) Nutt.

Wislizenus

188 Wislizeni Gray
1049 californica (T. & G.) Gray

Wolf

422 grandiflora (Hook.) Nutt.
423 " " "

Wolf & Rothrock

422 grandiflora (Hook.) Nutt.
423 " " "

Wooton

124 grandiflora (Hook.) Nutt.
335 Fendleri Gray
340 grandiflora (Hook.) Nutt.
384 brachyphylla Gray
451 Rusbyi Gray
488 californica (T. & G.) Gray
490 grandiflora (Hook.) Nutt.
2605 scabra (Gray) Nels.
3940 Fendleri Gray
brachyphylla Gray
californica (T. & G.) Gray
Fendleri Gray
floribunda Gray
grandiflora (Hook.) Nutt.
grandiflora, v. petiolaris Gray
laciniata Gray
Lemmoni, v. Wootoni (Greene) Robinson
Rusbyi Gray
venosa (Wooton & Standley) Robinson

Wooton & Standley

3646 grandiflora (Hook.) Nutt.
californica (T. & G.) Gray
grandiflora (Hook.) Nutt.
laciniata Gray
Lemmoni, v. Wootoni (Greene) Robinson

Worthen

argyrolepis Robinson

Wright, C.

249 parvula Gray
250 cylindracea Gray & Engeln.
251 californica, v. reniformis (Gray) Robinson
252 baccharidea Gray
253 laciniata Gray
293 diffusa (Vahl) Gray
1135 venosa (Wooton & Standley) Robinson
1136 amplexicaulis Robinson
1137 betonicaefolia Gray
1138 " "
1139 californica (T. & G.) Gray
1140 californica, v. tenera (Gray) Robinson
1141 floribunda Gray
1142 Fendleri Gray
1143 grandiflora (Hook.) Nutt.
1144 simplex Gray
cylindracea Gray & Engelm.
dentata (DC.) Sch. Bip.
diffusa (Vahl) Gray

Wright, W. G.

7 californica (T. & G.) Gray
1290 diffusa (Vahl) Gray

Xantus

peninsularis Brandegee

Zuck

50 californica (T. & G.) Gray
californica (T. & G.) Gray

Zumbro

362 desertorum Coville
420 californica (T. & G.) Gray

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II

PERSISTENCE OF PLANTS IN UNGLACIATED AREAS OF BOREAL AMERICA

BY

M. L. FERNALD

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INTRODUCTION

The vast majority of plants of continental regions are widespread and somewhat general in occurrence in proper habitats over extensive areas. For instance, such a tree as the Pitch Pine of eastern North America occurs on sandy or other light and sterile soils from southern Maine to Lake Ontario and south to the hills of northern Georgia and Tennessee; or the common Pitcher Plant occurs in peat-bogs from Florida to the southern slope of the Labrador Peninsula and west through the northern states and Canada to Iowa and Mackenzie. Although not found everywhere throughout these areas they are to be expected in the proper habitats and the discovery of new stations for them within their broad areas of distribution are of only local interest.

The plants which characterize the arctic regions, however, show an amazingly disrupted occurrence,—on various islands of the Arctic Archipelago or on the arctic or subarctic coasts of America and in the arctic regions of Eurasia, with localized colonies isolated far to the south; on bleak spots in the alpine areas of the Pyrenees, the Alps, the Carpathians, Himalayas, Altai, Rocky Mountains of Alberta or of Colorado, Mt. Washington in New Hampshire or Mt. Katahdin in Maine. So general is this type of arctic-alpine distribution both of plants and of animals that discussion of it may seem like forcing a threadbare topic. Hooker, Darwin, Forbes, Hemsley, Gray, Dana and hosts of others have written extensively upon it. The concensus of opinion has been that, during Pleistocene time (the Glacial Period) the cold of boreal America was so intense and uninterrupted that essentially no life could exist on the Arctic Archipelago and that the hundreds of plant species, and with them their associated insects, snails and other animals, left the North and gradually migrated south, upon the retreat of the glacial fields to return northward again to occupy the Arctic Archipelago; and that during their residence in the South these species found a few favorable spots, like alpine summits in temperate latitudes, where they have lingered as relics of the great Pleistocene invasion from and remigration toward the Arctic regions.

During the last quarter century our study of alpine floras in eastern North America has extended to the regions northeast of New England and there hundreds of species of plants have been found mingling with the well known arctic-alpine species but, unlike them, mostly quite unknown to the north. These plants, occupying the alpine tablelands and ravines of the Shickshocks Mts. of the Gaspé Peninsula or of the Long Range of western Newfoundland, are for the most part otherwise known only in the cordillera of western America (in the Rocky Mts., the Cascades, Sierra Nevada or Coast Ranges) or in some cases in Alaska or on the Altai of Siberia. As stated, they are quite unknown in eastern America to the north of the Gulf of St. Lawrence or to the southwest of the Gaspé Peninsula. In a few cases western plants occur likewise upon the Magdalen Islands (in

the middle of the Gulf of St. Lawrence) and in several cases they are found upon the Torngat Mountains, the high, rugged sierras of northeastern Labrador. Extensive exploration has failed to discover these western plants upon the mountains of northern New England and northern New York, summits often twice the height of those of Gaspé and Newfoundland. Consequently, it is not possible to explain their isolation in the region bordering the Gulf of St. Lawrence as due to post-glacial dispersal of seeds from the West by strong winds. Surely, if plants of California or Colorado had reached Gaspé or western Newfoundland since the receding of the Labrador ice-sheet by wind-dispersal, their seeds should have first found congenial landings on the more western and much higher Adirondack, Green and White Mountains or upon Mt. Katahdin. Similarly, attempts to explain the occurrence of the western plants about the Gulf of St. Lawrence as due to recent transportation by water or by birds and other animals or by migration directly across the continent near the former ice-front are wholly unsatisfactory.

In connection with the occurrence in Gaspé and western Newfoundland of these hundreds of Cordilleran, Alaskan or Siberian species another point of great significance should be noted. This is the very large proportion of strictly endemic species found in these areas. There are more than 80 of these endemic species, plants with fundamental or deep-seated characters in their reproductive organs, all related to plants of British Columbia, Alberta, Washington, California, or Colorado and isolated by distances averaging 2000 miles from their nearest allies. Contrasted with this condition in Gaspé and western Newfoundland the situation in Atlantic western Nova Scotia is illuminating. There, in a region of highly siliceous rock, which was denuded by the Pleistocene glaciers, the flora contains nearly 200 species which, after the receding of the glacial ice, made a landing off the coastal plain which has subsequently become submerged and which now forms the continental shelf or banks off Nova Scotia. These are all plants derived from the southern coastal plain, some of them unknown nearer than the Pine Barrens of New Jersey, one at least unknown nearer than the Carolinas, and nearly all characteristic of the sandy coastal strip from southern New Jersey to Florida and Mississippi, there occurring in a climate obviously much warmer than that of the foggy coast from Digby and Yarmouth Counties to Guysborough, Nova Scotia. Yet in the 25,000 years (more or less) since this flora of far-southern origin became isolated on the Atlantic slope of Nova Scotia it has set off only a single endemic species and that a rapidly reproducing annual, the specific validity of which has been doubted. Otherwise the most Nature has accomplished in Nova Scotia toward segregation from the southern types is the slight increase of hairiness or the modification of stature or foliage in about a dozen species. If we reason that the more thoroughly differentiated species, those with deep-seated differences in flower and fruit, are older than those which show only slight departures from type, then surely the floras of Gaspé and western Newfoundland, with their 80 endemic species mostly unrelated to any plants known nearer than about 2000 miles due west, are vastly older than the flora of Atlantic Nova Scotia.

Since the various lines of evidence seem to indicate that the peculiar floras which dis-

tinguish the Shickshock Mts. and the sea-cliffs of eastern Gaspé and the Long Range of Newfoundland and some other areas about the Gulf of St. Lawrence are far more ancient in their occurrence there than are the floras which occupy the strongly glaciated areas like central and eastern Newfoundland, Nova Scotia and New England, it has seemed important to look into the Pleistocene history of these regions. Very briefly, it is the conclusion of such Canadian geologists as Bell, Chalmers, Coleman and Alcock, that the Labrador ice-sheet did not cross the Shickshock range and that in the eastern two-thirds of the Gaspé Peninsula glaciation was extremely local, many areas remaining quite free from ice. Analysis of the local distribution on the Peninsula of the Cordilleran and other western plants and of their endemic allies brings out very strikingly the fact that their stations are just exactly on the spots which escaped extreme glaciation and, more amazing still, that they have signally failed to migrate westward into the closely adjacent and lithologically similar areas which were occupied by the Labrador ice-sheet and its Chaleur lobe. This failure of the plants of the unglaciated spots to extend their ranges into closely adjacent areas which, upon the melting of the Labrador sheet, became open territory ready for invasion, is interpreted as a further evidence of the antiquity of these plants; at the close of the Pleistocene they were already too old and conservative to pioneer, although they are able to linger as localized relics in their special undisturbed crannies and pockets.

The Magdalen Islands, as pointed out by James Richardson, Chalmers, J. M. Clarke and Coleman, have on their higher hills deep beds of rotted rock which have not been removed by the passage over the islands of a continental ice-sheet; and upon these islands which were outside the area of profound continental glaciation we find in the limited flora several endemic plants and others which have their general occurrence in the western United States. Similarly, the Torngat Mts. of northern Labrador, although never visited by a trained systematic botanist, have yielded to amateur collectors several of the cordilleran species which are otherwise unknown in the East except on the Shickshock Mts. or the Long Range and several others known only on the Torngats and the Rocky Mts. and about 10 endemic representatives of cordilleran species. It is, consequently, significant that all geologists who have visited the Torngat Mts. since 1860, Lieber, Koch, Bell, Daly and Coleman, agree that the region, which reaches elevations of 7000 feet or more, has not been glaciated above the 2100 foot level. The area of driftless country is not yet known but Coleman states that this condition prevails for 80 miles along the coast and at least 50 miles inland.

In the case of Newfoundland, where the Long Range rises for about 300 miles along the Gulf of St. Lawrence as a series of almost perpendicular-walled and sharp-edged tablelands with elevations up to 2700 feet, we have no such authoritative assemblage of geological observations as in Gaspé, the Magdalen Islands and the Torngat Mts. The Pleistocene geology of Newfoundland has been but little studied on the spot. Jukes, Alexander Murray and John Milne long ago called attention to the great abundance of erratic boulders in eastern Newfoundland and their great rarity, "if they exist at all,"

on the western side of the island; and Chamberlain, after a brief visit, concluded that Newfoundland was not invaded by the Labrador ice-sheet but had had its own system of local ice-fields. Twenhofel alone among geologists who have visited Newfoundland has published the direct statement that the Newfoundland ice covered the island to the highest summits. Nevertheless Twenhofel himself, in describing one of the high tablelands of the Long Range, states that the surface is deeply covered by a mantle of angular gravel. Such conditions, with the high sharp-rimmed tablelands deeply mantled with angular residual debris, are general in the Long Range and strongly in contrast with the great central and eastern region of Newfoundland where the surface soils have been scoured away, drainage clogged and boulders strewn nearly everywhere. And the conclusion of the present writer, that glaciation in extreme western Newfoundland was local and confined chiefly to the lower levels, has been confirmed by the distinguished student of Pleistocene phenomena, Professor A. P. Coleman of Toronto. It is, therefore, of great significance to note that western Newfoundland, like the Gaspé Peninsula, is occupied largely by plants of the Cordillera or of Pacific America or by endemic allies of them (160 species thus far known). In Gaspé such plants have failed to invade the region to the west which was generally denuded by the Labrador ice-sheet. So in Newfoundland, the vast area of the island to the east of the Long Range where the Newfoundland ice-cap did extensive and general eroding is characterized by the almost complete absence of these western and endemic types. The younger flora which invaded glaciated central and eastern Newfoundland off the formerly emersed coastal plain or banks at the close of the Newfoundland glaciation shows no such restriction; these coastal plain types, only recently derived out of the South, being aggressive and invading the alpine regions of the Long Range as well as the youthful soils of the region to the east. This difference of behavior is interpreted like that shown by the plants of Gaspé; the recent arrivals are young and have the attributes of youth, aggressiveness and pioneering vigor; the western and endemic plants of the Long Range are old and have long since passed their period of aggressiveness. Left undisturbed they persist in their old habitats but they fail to move into new and immediately neighboring territory. It is, therefore, concluded that the distinctive plants of Gaspé, the Magdalen Islands, western Newfoundland and the Torngat Mts. there outlived the Pleistocene and that their absence from the regions which were denuded by the Labrador and the Newfoundland ice-sheets is due in the first place to their extinction from these areas; in the second, to the fact that they are so ancient and conservative that they have failed to occupy the recently available lands which lie between their now isolated refuges.

In studying the occurrence of the arctic species which reach western Newfoundland or Gaspé, but which do not extend to the much higher mountains of northern New England, the striking fact comes out, that these species, likewise, are found on the unglaciated Torngat Mts. but not elsewhere in Labrador, that they are generally distributed over the Arctic Archipelago and that they often follow the cordillera to Alberta or Colorado or are known in the Northwest only in Alaska. Such ranges when checked with Pleistocene

history are at once full of interest. The Arctic Archipelago during Pleistocene time was uplifted and formed continuous land confluent with the present North American continent; and the consensus of geological opinion is, that it was outside of the area covered by the great glacial fields of North America. Then, as now, it was too arid for the accumulation of deep snow, and then, as now, it was a region with only local valley-glaciers. Alaska, too, has had only local glaciers and these chiefly at the southern border, where warm and moist winds have favored abundant precipitation. The arctic plants which prior to the development of the Labrador ice-sheet had pushed south to Gaspé and Newfoundland or the Torngat Mts. are, then, in the Arctic Archipelago likewise confined today to a region which escaped Pleistocene glaciation. In the cordilleran region of Canada, where these arctic plants are often found, general glaciation occurred only at the opening of the Pleistocene. Ever since then the cordillera have been free from continental ice, and Pleistocene time subsequently saw the formation and waning of a series of successive glacial fields: first, in the region northwest of Hudson Bay; next, in a center almost due west of Churchill on Hudson Bay; then in the region west and southwest of James Bay; these forming the different advances of the Keewatin glaciers. Then, after a long interglacial interval, the Labrador sheets evolved; the first, near the divide east of James Bay, then a second Labradorean névé farther north, and finally a third center north of that. During all this vast Pleistocene time, with glacial fields successively gathering, advancing and waning in the area west, southwest, southeast and east of Hudson Bay, which seems to have been the great source of precipitation, the plants of the uninvaded and uplifted Arctic Archipelago had abundant time to follow the cordillera south; and it is certainly a fact of great significance that many of the arctic species which, prior to the Labrador glaciation, followed south in western America and to western Newfoundland or Gaspé have, like the cordilleran species isolated in the latter regions, given rise to many localized endemics. The plants of the Arctic Archipelago which have southern outliers localized on the unglaciated or but slightly glaciated areas about the Gulf of St. Lawrence are considered, then, to have lived throughout Pleistocene time in the Arctic and to have made their migrations southward long before the last glacial advance in eastern America. This interpretation is, of course, quite at variance with the long accepted idea that they abandoned the Arctic Archipelago and returned to their old home there after the waning of the glacial fields.

In considering the extent to which such plants can endure the climatic conditions of a glacial period, the present situation in Greenland is analyzed. Greenland is still in a glacial period, with a thick continental ice-cap covering all but the arid northwestern area and a comparatively narrow coastal rim. Yet in Greenland, with an area of more than 800,000 square miles (an area larger than the Labrador Peninsula) there are known 416 species of vascular plants. Of these, 279 (67% of the Greenland flora) occur south of the St. Lawrence or the Straits of Belle Isle, 243 of them (58½% of the Greenland flora) being known at or near sea-level; and 100 species (24% of the Greenland flora) occur in Massachusetts, Rhode Island or Connecticut. Furthermore, 75 species which occur in

Greenland (18% of its flora) are plants of temperate eastern America which reach their northeastern limits in America (outside of Greenland) at or near the Straits of Belle Isle (lat. 48°–54°). If Greenland, which is today occupied by a continental glacier as large as the individual ice-fields which occupied North America during the successive stages of Pleistocene time, can now support this comparatively southern flora, it should not strain the imagination to picture a flora composed of more boreal types outliving on the Arctic Archipelago the evolution, advance and diminution of the successive ice-fields which lay to the south or southeast.

Many of the plants which characterize arctic America and which have isolated southern colonies surviving in Gaspé or western Newfoundland are known in Europe only on the arctic island of Nova Zembla or on the adjacent smaller islands and headlands of arctic Russia and arctic Lapland. In Europe the four great glacial fields of the Pleistocene all centered on the Scandinavian area, the continental ice in the maximum glaciation (the second epoch) pushing south upon the continent and northeastward to the foot of the Timan Mts. (between the White Sea and the Ural). The third continental glacier invaded still less of arctic Russia, while the last or Great Baltic Glacier stopped at the northeast in western Lapland and Finland. During all these advances in Europe southern Scandinavia and the adjacent continent were covered; while Nova Zembla, and the adjacent islands and headlands, where occur the plants of the Arctic Archipelago which have their isolated eastern American stations restricted to the unglaciated areas about the Gulf of St. Lawrence, were quite uncrossed by at least the last two advances of the European ice-sheets. In Europe these essentially American plants were blocked from advance to the south by the occupation of their natural route of migration, the Scandinavian mountains, by all four of the European ice-fields and, just as in North America these species today show little if any tendency to pioneer, so in Scandinavia, where the de-glaciated Scandinavian alps offer most attractive habitats for them, they have rarely ventured out of the limited areas in which they were held trapped through the whole of Pleistocene time.

The situation here summarized leads to many other deductions which demand a closer analysis of exact data than is possible in this somewhat general statement. These deductions and the mass of data which lead to them are presented in some detail in the following pages.

CORDILLERAN AND OTHER WESTERN PLANTS IN EASTERN NORTH AMERICA

It has long been recognized that upon the higher mountains and the bleaker headlands of northern New England, eastern Canada and Newfoundland there is a considerable proportion of the species belonging to the arctic flora. Many of these plants, for instance *Lycopodium Selago* L., *Phleum alpinum* L., *Saxifraga oppositifolia* L., *Potentilla nivea* L., *Empetrum nigrum* L. and *Loiseleuria procumbens* (L.) *Desv.*, are of general circumpolar distribution; others, such as *Carex bicolor* All., *Lychnis (Viscaria) alpina* L., *Cerastium cerastioides* (L.) Britton, *Arabis alpina* L., *Phyllodoce caerulea* (L.) Bab. and *Gnaphalium supinum* Vill., reach the median latitudes in America only in the East; while still others, like *Cystopteris montana* (Lam.) Bernh., *Carex pratensis* Drejer, *Braya humilis* (C. A. Meyer) Robinson and *Parnassia Kotzebuei* Cham. & Schl., are rare or in some cases unknown within the Arctic Circle but occur from the subarctic regions southward in both eastern and western America. All three groups are, therefore, unquestionably arctic or subarctic species and they are generally accepted as relics left over in favorable habitats in temperate latitudes upon the northward migration of life following the Wisconsin glaciation. Typical ranges in North America of such species are shown in maps 1, 2 and 3,[1] illustrating the American distribution of the Black Crowberry or Curlewberry, *Empetrum nigrum* L. (map 1), the Alpine Rock-cress, *Arabis alpina* L. (map 2), and the small Grass of Parnassus, *Parnassia Kotzebuei* Cham. & Schl. (map 3).

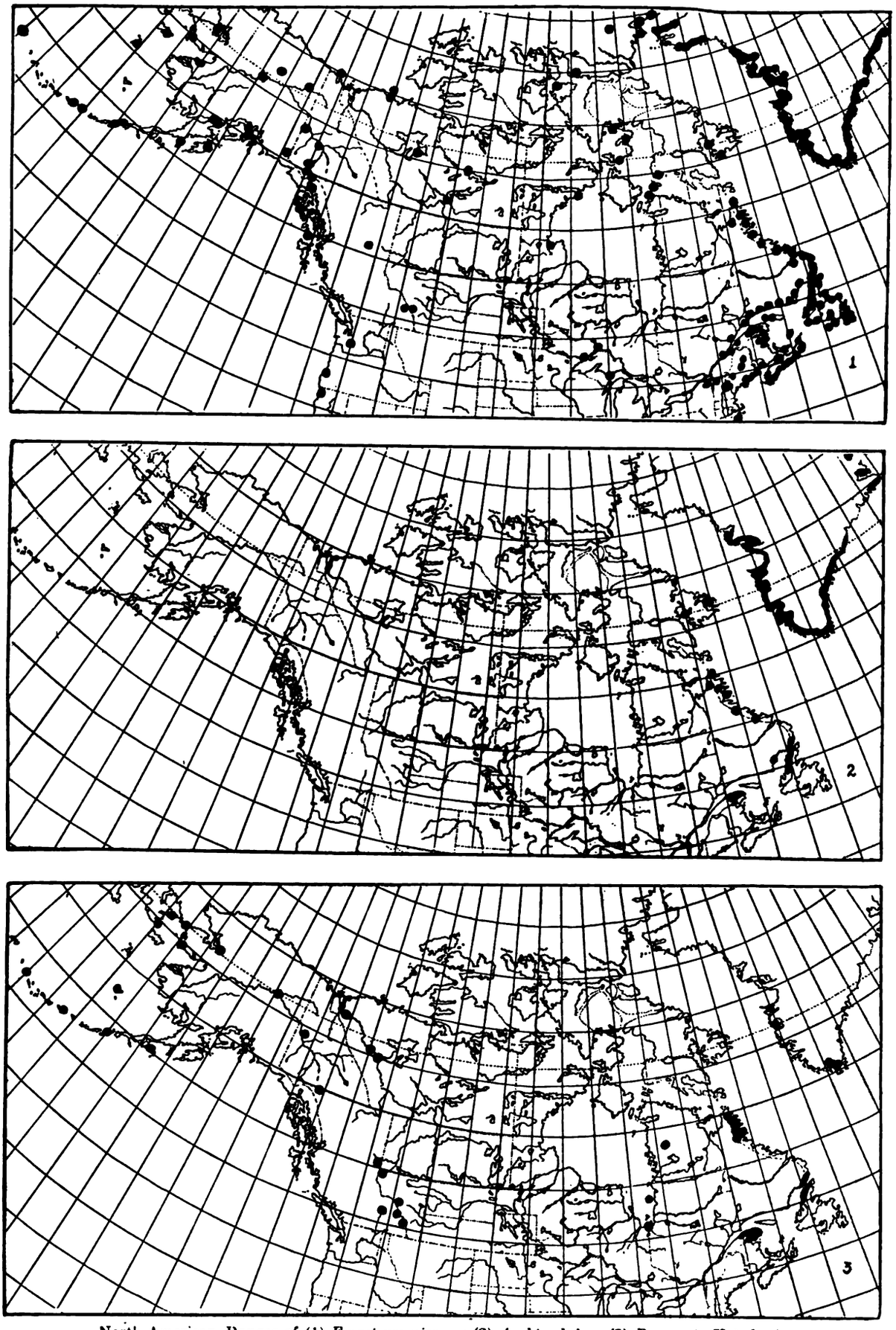
It has not been so generally recognized, on the other hand, that, mingled with the typical boreal and arctic-alpine species on the Shickshock Mountains[2] of the Gaspé Peninsula in eastern Quebec, the Long Range of western Newfoundland, and at various other points along the northeastern border of the American continent, there are many species which are in no wise arctic plants but which are characteristic of the central Rocky Mountains, the Cascades, the Sierra Nevada or the northern Coast Ranges of western North America. And, since the occurrence of this considerable cordilleran element in the flora of eastern America is becoming more and more apparent with every new botanical exploration in the regions centering about the Gulf of St. Lawrence or on the Torngat Mountains of northern Labrador, and, since the presence of these plants in the Northeast throws important light upon various problems of phytogeography and of Pleistocene and Tertiary geology, it seems appropriate to publish such data as have accumulated on this problem.

Among the western plants long known in the Shickshock Mountains is a peculiar rigid fern, *Polystichum mohrioides*, var. *scopulinum* (D. C. Eaton) Fernald,[3] a northern variety of *P. mohrioides* (Bory) Presl which occurs, always as an extremely rare and local plant, upon subantarctic

[1] The maps used in this paper are meant to illustrate in detail the ranges within the area of northeastern America specially discussed but, owing to the very scattered and too often untrustworthy data, they can be only approximately correct for other regions. Every effort has been made to eliminate unreliable records and to include all trustworthy data, but the specimens and records from many regions (such as Manitoba, British Columbia, Utah, Oregon and Nevada) are so meagre that the maps can be considered only as very general views of the ranges of the plants discussed.

[2] The Shickshock Mountains (often called on maps, but never by the people in the region, the Notre Dame Mountains) form the backbone (900–1360 m. high) of the Gaspé Peninsula, stretching from slightly east of Lac Metapedia to the valley of Rivière Madeleine.

[3] For detailed discussion of this plant and its systematic and geographic relationships see Fernald, Rhodora, xxvi. 89 (1924).



North American Ranges of (1) *Empetrum nigrum;* (2) *Arabis alpina;* (3) *Parnassia Kotzebuei.*

islands and from the Falkland Islands and Tierra del Fuego northward at remote stations along the Andes and, quite as locally, in the mountains of western North America. Our plant, var. *scopulinum* (map 4), is confined, so far as known, to about twelve stations in the world: two in southern California; two others more than 500 miles (800 km.) to the north, in the Shasta region of northern California; then, beginning at the Columbia, 300 miles (480 km.) farther north, a series of stations in the Cascade Mountains; and, fully 300 miles (480 km.) to the eastward, three Rocky Mountain stations, one on the Teton Mountains of eastern Idaho, one on the Mission Mountains of Montana and one near Great Salt Lake; while the most isolated and in our present study the most interesting station is more than 2000 miles (3200 km.) farther east, the dry headwalls of Snow Brook Ravine and Devil's Gulch on Mt. Albert, the great serpentine tableland of the Shickshock Mountains in Gaspé.

Another illustration, from among many, of this isolation of cordilleran plants in the Shickshocks is the beautiful little willow with silky-white foliage and tiny aments, *Salix brachycarpa* Nutt. (map 5), originally described from the neighborhood of Great Salt Lake but now known as a characteristic willow of the mountains and high plains from eastern British Columbia, Washington and Oregon eastward across much of Saskatchewan, Montana, Wyoming and Colorado, where it long passed under the highly appropriate but apparently erroneous name, *S. desertorum*.[1] East of longitude 95° W. *Salix brachycarpa* is definitely known in only a single region, 1500 miles (2410 km.) away in Gaspé County, Quebec, where the shrub abounds (with other localized willows, one of which is elsewhere unknown except in the Rocky Mountains) on the serpentine barrens of Mt. Albert.

Sharing the Shickshock Mountains with the Long Range and adjacent regions of Newfoundland are several cordilleran plants, of which the two grasses, *Danthonia intermedia* Vasey (map 6) and *Festuca scabrella* Torr. (map 7) may serve as illustrations. The Danthonia is a plant of mountain meadows, following the Cascades and the Sierra Nevada southward from southern British Columbia to middle California, and the Rocky Mountain axis from Alberta to northern New Mexico, with a few outlying stations eastward on the prairies to southern Manitoba. East of the Red River of the North the species is definitely known[2] to the writer only from the meadows of the Shickshock Range in Gaspé and of the Long Range in Newfoundland, though Macoun, who was familiar with the plant, recorded it from Anticosti. The Festuca is, in the West, characteristic of the more arid region east of the Cascades, thence extending eastward to western North Dakota, Wyoming and Colorado; then, after a gap of 1500 miles (2410 km.) it appears in the East on the asbestos area of Megantic County, Quebec, and on dry meadows of the Shickshocks and the Long Range.

Other plants, while characteristic of western America and of the Shickshock Mountains or the Long Range, are also found locally on the upper Great Lakes, especially about Lake Superior and occasionally about Lake Huron. This group is well illustrated by two ferns, *Pellaea densa* (Brack.) Hook. and *Woodsia scopulina* D. C. Eaton, and by the blueberry, *Vaccinium ovalifolium* Sm. *Pellaea densa* (map 8) is a very wiry fern with rigid, triangular fronds, found on dry rocky slopes. It is peculiarly characteristic of the Sierra Nevada of California and the Cascade and Coast Ranges northward into southern British Columbia. Across Washington and Idaho it extends eastward to the Rocky Mountains, where it has a single station in each of the three states, Montana, Wyoming and Utah. An extraordinary cordilleran station is recorded upon good authority[3] nearly 3000 miles (4800 km.) to the south, in Costa Rica, but the present center of

[1] See Schneider, Bot. Gaz. lxvi. 331 (1918).

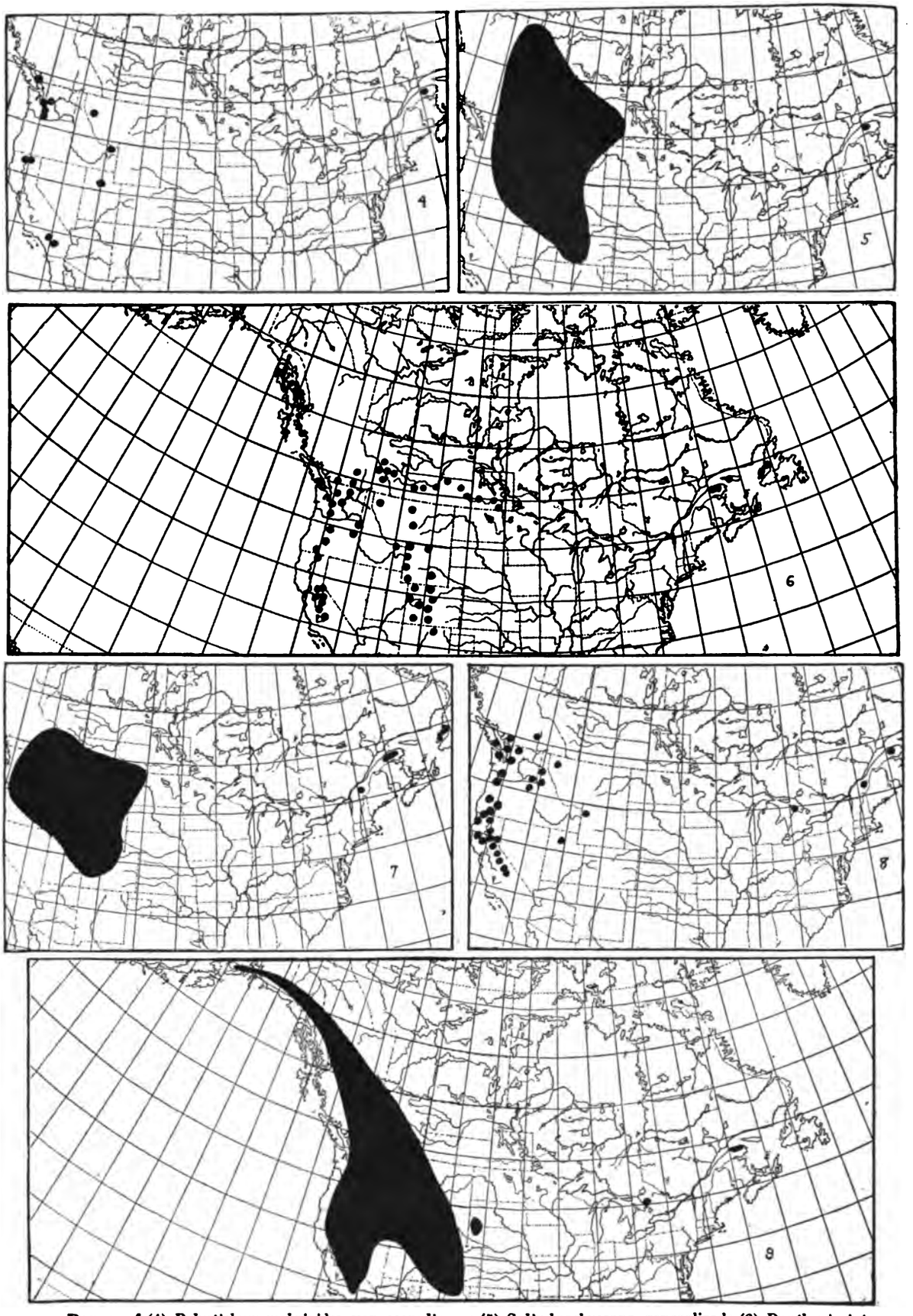
[2] The plant has been recorded from the Keweenaw Peninsula in northern Michigan but the specimens which the writer has seen from Keweenaw County are not satisfactory *D. intermedia*.

[3] Christ, Farnkräuter der Erde, 158 (1897); Christ, Die Geographie der Farne, 286 (1910); Christensen, Index Filicum, 479 (1906).

the species is along the Cascade-Sierra Nevada axis. About 1400 miles (2250 km.) to the east of its Rocky Mountain stations, *Pellaea densa* is found on that famous haven of isolated plants, the Bruce Peninsula, extending into Lake Huron; 500 miles (800 km.) farther east it next appears in the asbestos region of Megantic County, Quebec; and 350 miles (560 km.) farther to the northeast it occurs on the dry serpentine walls of Devil's Gulch on Mt. Albert. *Woodsia scopulina* (map 9) is characteristic of the Cascade, Sierra Nevada and Rocky Mountain regions and locally northwestward to the Kenai Peninsula, with an outlying colony in the Black Hills. About 1200 miles (1930 km.) east of there it reappears in the Nipissing District of Ontario and about 700 miles (1125 km.) farther to the northeast it abounds, as an isolated colony, on dry cliffs which form the northern outliers of the Shickshock Range in Gaspé County, Quebec.[1] *Vaccinium ovalifolium* (map 10) is characteristic of Washington and British Columbia, extending southward into Oregon and northwestward to southern Alaska. It is a shrub of the Coast Ranges and the Cascades, extending eastward into the Selkirks. It is not in the Rocky Mountains proper, but nearly 1300 miles (2090 km.) to the southeast of the Selkirks it appears on the Keweenaw Peninsula and again on Whitefish Point in Lake Superior; 800 miles (1290 km.) farther to the northeast it again appears, as a dominant shrub of the mountain woods throughout the Shickshock Range; while in Newfoundland it is known on the Long Range and on the hills about Notre Dame and White Bays, and it is on the high terraces north of the Straits of Belle Isle.

Still other plants of the alpine and subalpine areas of the Shickshocks and the Long Range, although, so far as known, local endemic species, have their closest affinities, not with circumpolar types but with species of cordilleran range. In the Rocky Mountains from Alberta to New Mexico *Arenaria obtusiloba* (Rydberg) Fernald is a characteristic plant of high altitudes, chiefly on rocky summits and ridges. It is very closely simulated both in habit and in selection of habitat by *A. marcescens* Fernald (map 11) of the serpentine barrens of the Shickshocks and the Long Range, but the two differ in very fundamental characters: *A. obtusiloba* with oblong and ciliate, densely imbricated leaves about 1 mm. wide, *A. marcescens* with smooth-margined, linear and loosely imbricated leaves 0.3–0.5 mm. broad; *A. obtusiloba* with glandular calyx and with rugose or papillose seeds, *A. marcescens* with the calyx not glandular and the seeds smooth or only obscurely pebbled. In other words, the two plants, separated by a distance of more than 1800 miles (2900 km.), have segregated as distinct species. One of the most distinctive genera of western North America is *Agoseris*, a group of dandelion-like plants. A single species has been known to extend eastward across the plains to Wisconsin and Illinois but, with this exception, the genus has been consistently recognized as belonging upon the western mountains or the adjacent high plains. One of the most characteristic species is *A. gracilens* (Gray) Kuntze (map 12), occurring along the mountains from southern Alberta and British Columbia to northern California, Nevada, Utah and Wyoming. On the subalpine meadows of the Tabletop Mountains, the great granite mass to the east of Mt. Albert in Gaspé, occurs the only known Agoseris in the eastern mountains. Superficially it is quite like *A. gracilens* but upon close examination it is found to differ in important characters of the fruit; and *A. gaspensis* Fernald is clearly a distinct species endemic to the Shickshock Mountains but representative of *A. gracilens* which reaches its eastern limit 2000 miles (3200 km.) to the west. Many other cases could be discussed: *Solidago chlorolepis* Fernald of Mt. Albert, the Shickshock representative of the Rocky Mountain *S. decumbens* Greene; *Cerastium terrae-novae* Fernald & Wiegand, the Long Range representative of the Rocky Mountain *C. Earlei* Rydberg; *Arnica pulchella* Fernald, the Long Range representative

[1] The Nipissing and Gaspé plants are quite inseparable from the typical cordilleran specimens. A fern of West Virginia has recently been identified with *Woodsia scopulina* but the West Virginian material at hand departs in some fundamental characters from the western and northeastern material of *W. scopulina* and seems to represent another species.



Ranges of (4) *Polystichum mohrioides*, var. *scopulinum*; (5) *Salix brachycarpa*, generalized; (6) *Danthonia intermedia*; (7) *Fectuca scabrella*, generalized; (8) *Pellaea densa*, excluding a station in Costa Rica; (9) *Woodsia scopulina*, generalized.

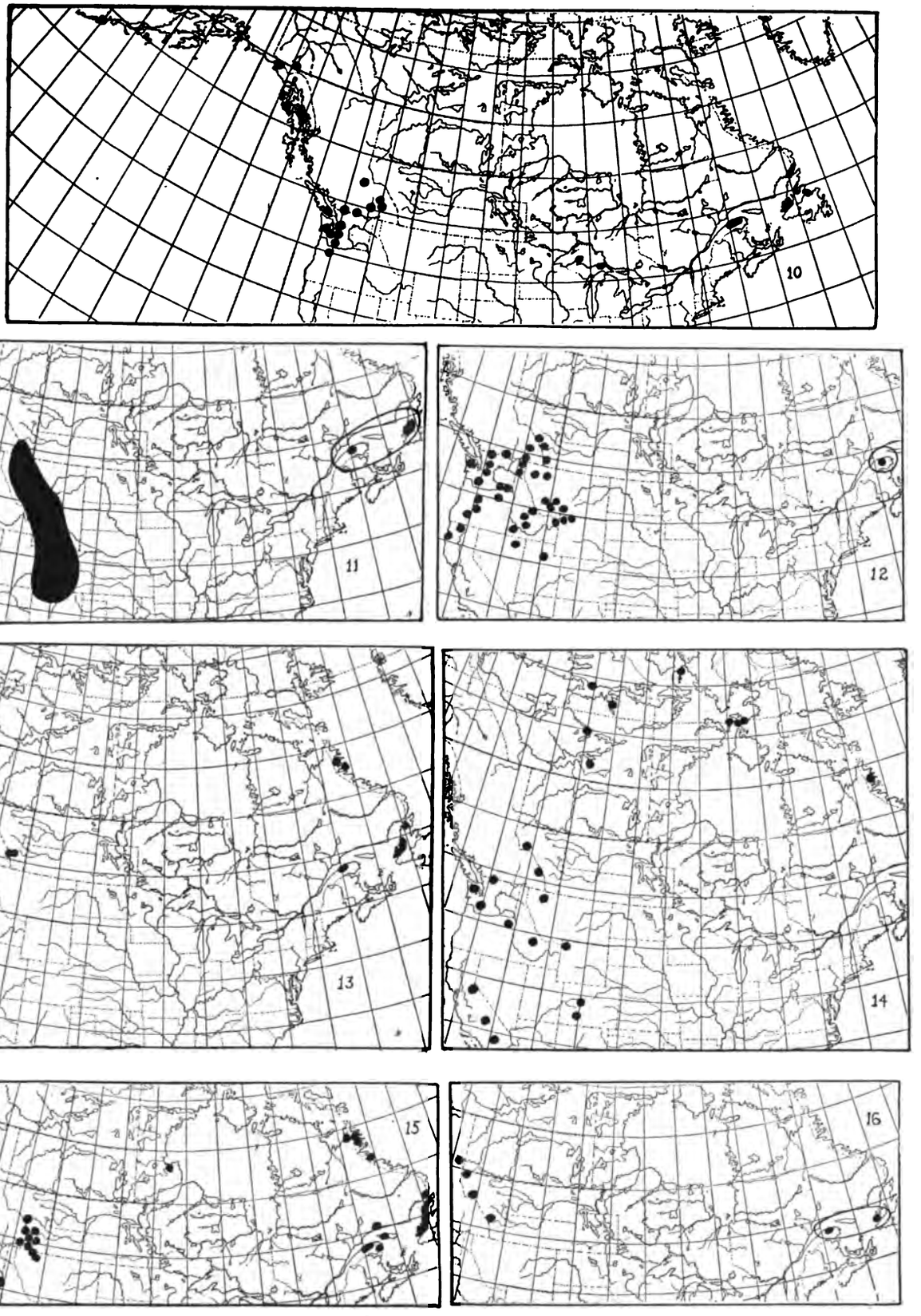
of *A. tomentosa* J. M. Macoun of the Canadian Rockies; and so on through a long list. For the immediate needs of this paper, however, these eastern endemic alpine representatives of cordilleran species are sufficiently illustrated by the few cases above discussed.

Another region with which the Shickshocks and the Long Range occasionally share otherwise endemic species or isolated colonies of western plants is the Torngat Mountain area of northern Labrador. Thus, *Arenaria cylindrocarpa* Fernald (map 13) occurs on the Long Range, the Shickshocks, the Torngats and, more than 2000 miles (3200 km.) away, on the Rocky Mountains of Alberta. The plants of the Torngats, furthermore, show their own distinctive identities with cordilleran types. Thus, the sedge, *Carex filifolia* Nutt., is very characteristic of high plains and dry ridges from Yukon to Oregon, New Mexico and Saskatchewan but in the East it is unknown except upon the Torngats. Again, the little composite, *Crepis nana* Richardson (map 14), although originally described from an extreme northern station, at the head of Coppermine River (north of Great Slave Lake) and now known north of the Arctic Circle, is more generally known on the high mountains of the Cascade-Sierra Nevada axis to southern California and along the Rocky Mountains to Colorado. Eastward its only known stations are on the Torngats.

Outside the Shickshock Mountains there are other areas of the Gaspé Peninsula which show similarly pronounced relationships in their floras: such regions as the cliffs and crests about Percé at the tip of the Peninsula; Tracadigash Mountain, near the head of the Baie des Chaleurs, and the cliffs and headlands from Percé around the northern coast of the Peninsula; while farther west, especially on the rugged headlands from Bic to St. Fabien in Rimouski County, this western affinity is again conspicuous. Thus *Salix vestita* Pursh (map 15) occurs on the Long Range and the low foreland between it and the Gulf, the Shickshock Mountains, the cliffs of Percé, Anticosti and the Mingan Islands, the limestone terraces at the Straits of Belle Isle in southeastern Labrador, the Torngat region, Churchill on the west shore of Hudson Bay, the Rocky Mountains of southern Alberta and British Columbia and northwestern Montana, and the Wallowa Mountains of northeastern Oregon, and, still farther away, on the Altai of Siberia and at a single station in Russian Lapland. *Arnica chionopappa* Fernald, of the Long Range and of Cape Rosier, Percé and other regions of Gaspé southwestward into northern New Brunswick, is clearly an eastern representative of *A. arnoglossa* Greene of the Black Hills. The section *Frigidae* of the great genus *Carex* has two specially notable Rocky Mountain species, *Carex petricosa* Dewey and *C. Franklinii* Boott, both excessively rare plants, the two together thus far known from only three or four stations in Alberta and British Columbia. On Table Mountain on Port à Port Bay and on the adjacent St. George Peninsula in western Newfoundland and on the high cliffs above Lac Pleureuse in Gaspé County, Quebec, occurs a third species of the *Frigidae*, *C. misandroides* Fernald (map 16), in some of its variations closely simulating *C. Franklinii*, in others as similar to *C. petricosa*, yet differing from them both in fundamental characters of the fruit.

The cordilleran relationship at Bic is clearly shown by *Arabis Collinsii* Fernald, originally described from Bic where it is abundant, but now known to occur also in South Dakota and Alberta; and by *Antennaria subviscosa* Fernald, the eastern representative of the cordilleran *A. rosea* (Eaton) Greene and *A. microphylla* Rydberg. It is also well shown by *Woodsia oregana* D. C. Eaton (map 17), a well known species on dry ridges and slopes from southern British Columbia and Alberta to southern California, Arizona, Colorado and the Black Hills region. East of the Black Hills this fern next appears about 750 miles (1200 km.) away, on the Keweenaw Peninsula, and its only other known eastern station is 900 miles (1440 km.) east of Keweenaw Point, on the dry slaty ledges of Cap Enragé at Bic, where it is associated with other cordilleran species and with endemic allies of western plants.

Anticosti Island, although sharing to some extent the West American plants which appear



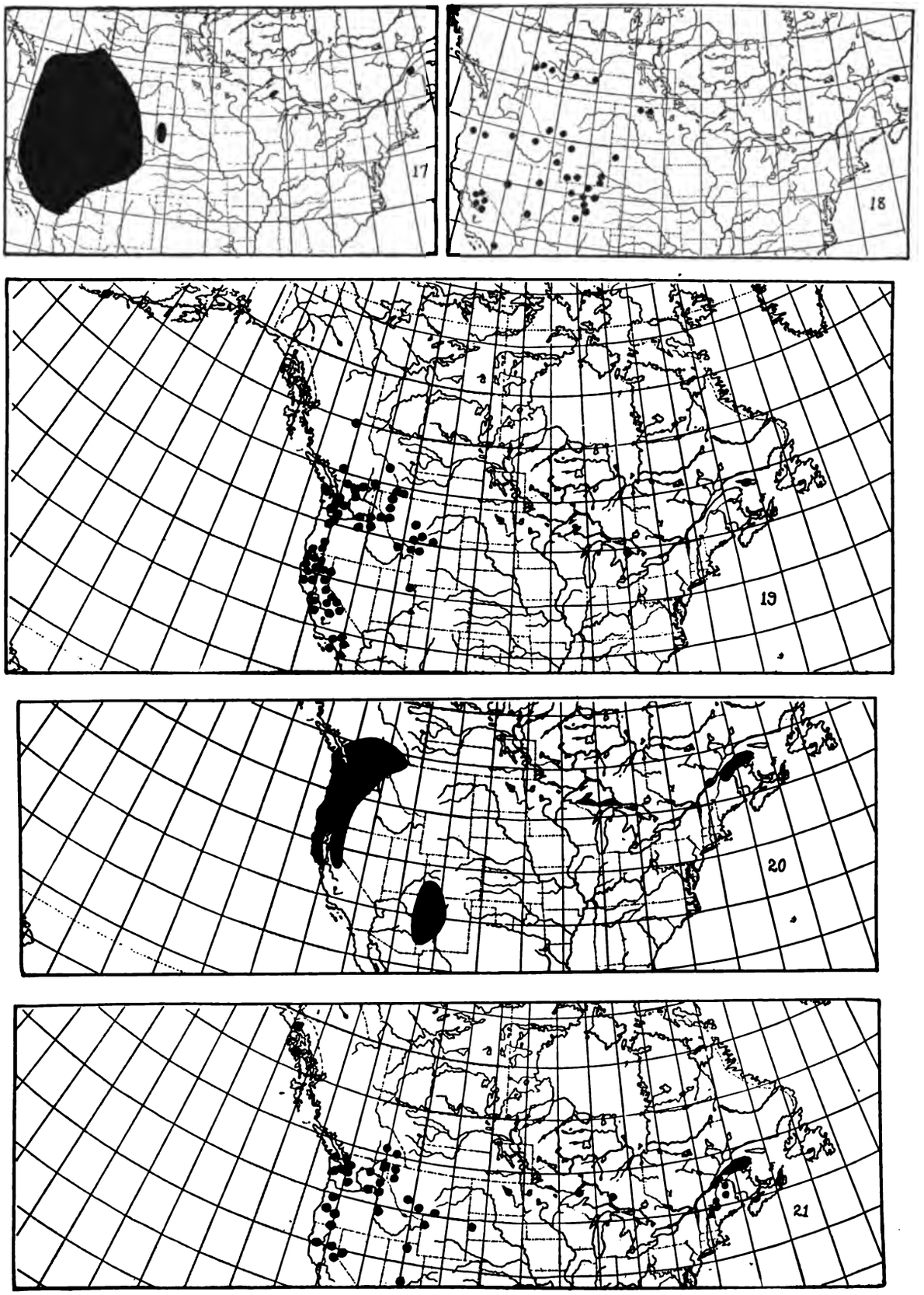
Ranges of (10) *Vaccinium ovalifolium;* (11) *Arenaria obtusiloba,* solid, and *A. marcescens,* in ellipse; (12) *Agoseris graculens,* cordilleran, and *A. gaspensis,* in circle; (13) *Arenaria cylindrocarpa;* (14) *Crepis nana,* excluding stations on Norton Sound, Alaska, and in the Baikal-Altai region of Asia; (15) *Salix vestita,* excluding Altai stations; (16) *Carex petricosa* and *C. Franklinii,* Rocky Mountains, and *C. misandroides,* in ellipse.

in Gaspé or western Newfoundland, has a few notable species which are unknown elsewhere in the East. As good illustrations as any are *Erigeron lonchophyllus* Hook. and *Habenaria unalascensis* (Spreng.) Wats. The Erigeron (map 18) is characteristic of mountain meadows and banks of streams from Saskatchewan and Alberta to Oregon, southern California, Utah, Colorado, the Black Hills of South Dakota and Devil's Lake in North Dakota. East of Devil's Lake it is quite unknown in the 1400 miles (2250 km.) to the mouth of the St. Lawrence; but in a little collection brought back in 1861 by Hyatt, Shaler and Verrill from Jupiter River, Anticosti, and for more than half a century left unrecognized in the original package at New Haven, is perfectly typical *E. lonchophyllus* and the original memorandum indicated the appropriate habitat: "abundant on grassy banks near the mouth of Jupiter River." *Habenaria unalascensis* (map 19), although its name suggests a northern range, is concentrated in the mountains from southern British Columbia and Alberta southward along the Cascades, Sierra Nevada and Coast Ranges quite to San Diego,[1] and more locally in the Rocky Mountains to eastern Utah. East of the Rocky Mountains it is known from only three points: somewhere on Lake Superior, where it was collected by the late William Boott (presumably on Keweenaw Peninsula where Boott is known to have botanized); Fishing Islands at the base of Bruce Peninsula (already referred to) and Jupiter River, Anticosti.

The Mingan Islands, north of Anticosti, likewise harbor several cordilleran types and have one notable endemic belonging to an otherwise cordilleran group. Thus, on the limestones of the Mingan Islands and Anticosti are the only known eastern stations for the scarlet-fruited Alpine Bearberry, *Arctostaphylos rubra* (Rehder & Wilson) Fernald, of the Canadian Rocky Mountains and remote mountains of China and southern Siberia, although the shrub has an intermediate station at Fort Churchill on the west side of Hudson Bay. With the Long Range of Newfoundland the Mingans share the eastern stations for *Erysimum asperum* (Nutt.) DC.; with western Newfoundland and Anticosti they have the endemic *Gentiana nesophila* Holm; and very locally on the sea-strand Professor Marie-Victorin discovered in 1924 a remarkable endemic thistle, clearly an eastern representative of *Cirsium* § *Foliosa*, a cordilleran section of the genus heretofore unknown east of Saskatchewan.

Northern Cape Breton Island, too, although lacking the more alpine types, occasionally shares with the Gaspé region and adjacent areas typical plants of the cordilleran forests, and the species, being lowland plants, have an intermediate area in the Lake Superior region and they have often extended their ranges from their eastern centers to the surrounding country. Thus, the large Rattlesnake Plantain, *Epipactis decipiens* (Hook.) Ames (map 20), the largest member of the genus, is typical of the mountain woods from southern British Columbia and northwestern Montana to the northern Coast Ranges and the northern Sierra Nevada of California. In the southern Rocky Mountains it has an apparently isolated area extending from southern Colorado and adjacent Utah into New Mexico and Arizona. 1200 miles (1930 km.) east of its Montana limit it is found on the North Peninsula of Michigan, extending from the Ontonagan region nearly to Sault Ste. Marie; 750 miles (1200 km.) farther to the east it becomes a frequent species of mountain woods of the Gaspé Peninsula, whence it extends very locally southwestward to Montmorency County, Quebec and northern Aroostook County, Maine; and 200 miles (320 km.) to the southeast of Gaspé it has another isolated area, the northern half of Cape Breton. Very similarly, *Osmorhiza divaricata* Nutt. (map 21) extends from southern Alaska to California and eastward to the Black Hills; it is about Lake Superior (Isle Royale and Algoma); on the Gaspé Peninsula it is a dominant woodland plant, whence it extends very locally across northern Maine

[1] Ames (Orchidaceae, iv. 125) includes in the southern range of *H. unalascensis* Lower California; but all the stations cited by him are in California proper, though the species may be expected somewhat south of San Diego.



Ranges of (17) *Woodsia oregana*, generalized; (18) *Erigeron lonchophyllus*, excluding stations in the Baikal-Altai region of Asia; (19) *Habenaria unalascensis;* (20) *Epipactis decipiens*, generalized; (21) *Osmorhiza divaricata.*

to northern New Hampshire; it is frequent on northern Cape Breton and there is a local colony on the North Mountain in Annapolis County, Nova Scotia.

Although not within the area specially covered by this paper, the region of the upper Great Lakes so often has localized colonies of western plants that it may appropriately receive brief comment. Of the western plants isolated about the Gulf of St. Lawrence several have already been noted from Keweenaw Peninsula, the Bruce Peninsula, Whitefish Point or elsewhere near Lake Superior or Lake Huron: *Pellaea densa* (map 8), *Woodsia scopulina* (map 9), *Vaccinium ovalifolium* (map 10), *Woodsia oregana* (map 17), *Habenaria unalascensis* (map 19), *Epipactis decipiens* (map 20) and *Osmorhiza divaricata* (map 21); and the list might be considerably increased. In addition to such species, which, so to speak, have a stepping-stone near Lake Superior or Lake Huron, there are several other western plants isolated on the Keweenaw Peninsula, Isle Royale, the Bruce Peninsula or elsewhere in the upper Lake region, which do not seem to have reached the shores of the Gulf of St. Lawrence. Thus, the very easily recognized grass, *Bromelica Smithii* (Porter) Farwell, occurs on the Bruce Peninsula, on the Keweenaw Peninsula and locally eastward to Whitefish Bay and south to the northern counties of the southern peninsula of Michigan, and on Isle Royale; but west of Lake Superior it next appears as a cordilleran species, from southern British Columbia to Wyoming and Oregon. The famous and tremendously obnoxious Devil's Club, *Oplopanax horridum* (Sm.) Miq.[1] (map 22) of the damp forests from southern Alaska to Oregon and Montana has two famous isolated areas: one 5000 miles (8050 km.) away in Korea and Japan, where it is sometimes considered a distinct species; the other 1200 miles (1930 km.) east of the Montana stations, on Isle Royale and adjacent small islands of Lake Superior. The handsome white-flowered *Rubus parviflorus* Nutt. is widely dispersed in western America, from Alaska to northern Mexico; then in the Black Hills and, again, as a somewhat wide-spread species about Lakes Superior and Huron and the northern end of Lake Michigan. *Ceanothus sanguineus* Pursh, a characteristic shrub from southern British Columbia to northern California and the western slope of the Rocky Mountains in Montana, is unknown on the eastern slope of the Rockies, but it appears in rocky woods on the Keweenaw Peninsula.[2]

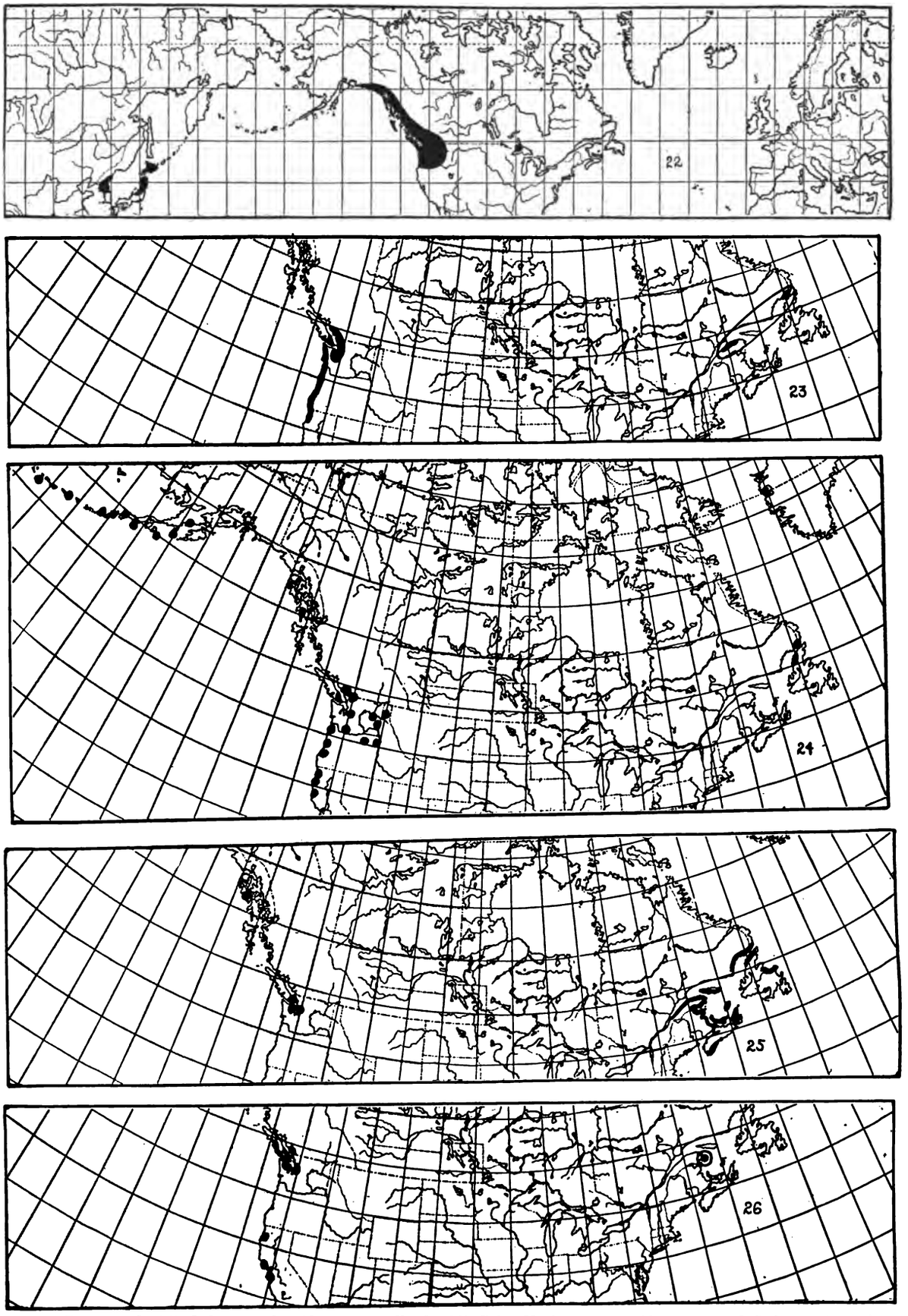
The plants thus far discussed are chiefly alpine, subalpine, woodland, headland and meadow types. The same western relationship is indicated, however, in the plants of the seashores and of the saline and subsaline habitats. Upon the steep lower terraces, at the mouths of brooks and on the upper borders of shingly beaches of the lower St. Lawrence on the north side of the Gaspé Peninsula (from northern Gaspé County to western Matane County)[3] is a coarse willow, *Salix laurentiana* Fernald, with leaves of the water-sprouts sometimes 2 dm. long and 9 cm. wide and aments sometimes reaching a length exceeding 1 dm. When it was originally described, *S. laurentiana* was considered the eastern representative of *S. amplifolia* Coville of the seacoast of southern Alaska, but the Austrian specialist on willows, Mr. Camillo Schneider, in his extensive studies of American species, places[4] it closer to a near relative of *S. amplifolia*, *S. Hookeriana* Barratt of the coast from southern British Columbia to northern California. *S. laurentiana* (map 23) closely follows the shores of the lower St. Lawrence and in the eighteen years since its discovery it has never been found away from the coast. It is, therefore, of more than usual interest to note that the habitat of its Pacific coast relative, 2400 miles (3860 km.) away, is so similar; the veteran Oregon botanist, the late Thomas Howell, explicitly stating that it is a "plant of the seacoast and salt marshes, usually growing on the margins of ponds, but confined in

[1] For discussion of nomenclature see Fernald, Rhodora, xxvi. 123 (1924).

[2] Farwell, Rhodora, xvii. 230 (1915).

[3] Schneider cites material which I have not seen from the north side of the Straits of Belle Isle.

[4] Schneider, Journ. Arn. Arb. i. 223 (1920).



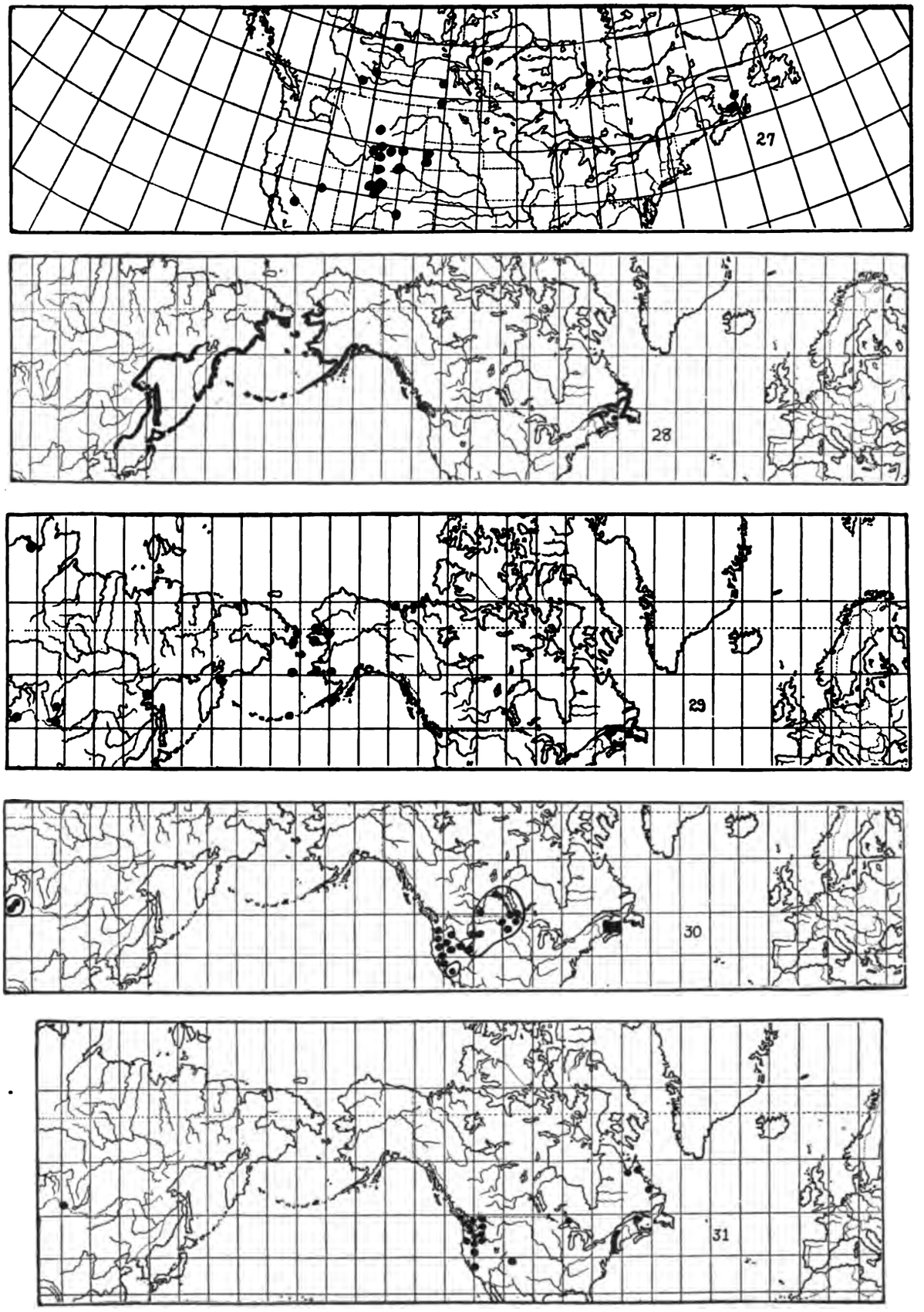
Ranges of (22) *Oplopanax horridum*, generalized; (23) *Salix Hookeriana*, Pacific coast, and *S. lasiandra*, in ellipse; (24) *Hordeum boreale;* (25) *Polygonum Fowleri;* (26) *Puccinellia nutkaensis*, Pacific coast, and *P. macra*, in circle.

its range to the immediate proximity of the sea,"[1] while Ball, in his treatment of *S. Hookeriana*, defines it as "A species occurring mainly near the ocean beach, . . . from Vancouver Island to Humboldt County, California."[2] *Hordeum boreale* Scribn. & Sm. (map 24) follows the Pacific coast from the Commander and the Aleutian Islands to northern California, pushing inland across Washington and Oregon to northern Idaho. 2700 miles (4350 km.) to the eastward it again appears as a characteristic grass of the sea-beaches in northwestern Newfoundland and at the Straits of Belle Isle. The salt marshes and saline rocks along the north shore of the Gaspé Peninsula are often carpeted by a peculiar plantain, *Plantago eriopoda* Torr., which follows the coasts of Gaspé and Matane Counties and extends locally westward to Kamouraska and Bay St. Paul; it is also on Anticosti. West of Charlevoix County, Quebec, it next appears 1100 miles (1770 km.) to the west, in the valley of the Red River in northwestern Minnesota, whence it extends across the alkaline plains to New Mexico, Nevada and British Columbia. *Polygonum Fowleri* Robinson (map 25) is a species of the sea-strands, occurring chiefly on gravel or shingle. Originally described from eastern New Brunswick, it is now known as a somewhat general species about the estuary of the St. Lawrence and the Gulf (Gaspé Peninsula, Anticosti, Magdalen Islands, Prince Edward Island, Cape Breton, eastern New Brunswick, etc.) and its range extends northward through the Straits of Belle Isle and southward very locally to the outer coast of Nova Scotia. Its area of distribution in the East, however, clearly centers on the Gulf of St. Lawrence. On the Pacific coast a plant which is certainly identical follows the coast from Sitka to Puget Sound. The halophytic genus *Puccinellia* is represented about the Gulf of St. Lawrence by several endemic or geographically isolated species. Among these grasses is *P. macra* Fernald & Weatherby (map 26), known only from two stations at the tip of the Gaspé Peninsula, a plant nearest related to *P. nutkaensis* (Presl) Fern. & Weath. of the Pacific coast from Vancouver Island and Puget Sound to San Mateo County, California; and another species, *P. lucida* Fern. & Weath. occurs on the lower St. Lawrence and in saline soils from Wyoming to British Columbia and California.

The subsaline sands of the Magdalen Islands, Prince Edward Island and eastern New Brunswick, regions of comparative warmth (with native oyster beds) and low altitudes, are at once distinguished by the presence of *Aster laurentianus* Fernald, a unique little plant which has shown a marked tendency to produce insular varieties; one confined to Prince Edward Island and the southwestern end of the Magdalen Islands, one to the northern end of the Magdalen archipelago, and a third to sands of northeastern New Brunswick. The only close relatives of *A. laurentianus* are *A. frondosus* (Nutt.) T. & G. of the Great Basin region of western America and *A. angustus* (Lindl.) T. & G. of brackish and saline habitats in Afghanistan, Thibet and the Great Plain region of North America. Another western type confined in the East to the Magdalen Islands and Prince Edward Island is the little pondweed, *Potamogeton filiformis*, var. *Macounii* Morong (map 27), found in pools and slow streams on these islands of the Gulf of St. Lawrence; then at the mouth of Moose River, James Bay; then from Manitoba to western Alberta and California.[3]

There are other geographic connections of these isolated plants which should be taken into account in studying the reasons for their present discontinuous ranges. Some of the plants already enumerated as isolated from western North America upon one or another of the lands bordering the Gulf of St. Lawrence or upon the Torngat area, occur in the West chiefly or exclusively beyond the Rocky Mountains and extend from California, Oregon or Washington northwestward along the north Pacific to the Aleutian or even to the Commander Islands; such plants

[1] Howell as quoted by Schneider, l.c. 219 (1920).
[2] Ball in Abrams, Ill. Fl. i. 500 (1923).
[3] See St. John, Rhodora, xviii. 137 (1916).



Ranges of (27) *Potamogeton filiformis*, var. *Macounii;* (28) *Senecio Pseudo-Arnica;* (29) *S. resedifolius;* (30) *Aster frondosus*, western America, *A. angustus*, in circles, excluding stations in Afghanistan, and *A. laurentianus*, oblong block; (31) *Arenaria macrophylla*.

as *Vaccinium ovalifolium* (map 10), *Habenaria unalascensis* (map 19) and *Hordeum boreale* (map 24). These ranges in the Northwest inevitably call to mind the large number of species which are isolated in eastern America but which have their centers of distribution northwest of the Rocky Mountain axis, in the region of Bering Sea or at the border of the North Pacific. This element in our flora is well illustrated by the only boreal Maidenhair Fern, *Adiantum pedatum*, var. *aleuticum* Rupr. or *A. boreale* Presl. As its name implies, this fern was originally described from the Aleutian Islands. Thence it extends on the west of Kamchatka and Japan and on the east along the western slope of North America to southern California. Across southern British Columbia and Washington it spreads very locally to the Rocky Mountain axis, but its next eastern area is 2000 miles (3200 km.) away, on the serpentine outcrops extending from Megantic County, Quebec, into northern Vermont; it is next found on the serpentine tableland of Mt. Albert in Gaspé and on similar habitats on the Long Range of Newfoundland. The splendid sunflower-like *Senecio Pseudo-Arnica* Less. (map 28) abounds on the shores of Bering Sea, thence southwestward to Japan and northern Korea and southeastward to Vancouver Island. Otherwise it is known only as a sea-strand plant centering on the Gulf of St. Lawrence but with outlying stations northward beyond Hamilton Inlet and very rarely southward to Grand Menan Island at the entrance of the Bay of Fundy; and it has a well-marked variety endemic to the Mingan Islands.

Such illustrations might be many times increased, but a single additional example must suffice. In 1818 that wonderful student of the Siberian flora, Ledebour, described *Cineraria lyrata* from the Altai of central Asia. Subsequently the Altai plant proved to be specifically inseparable from *Senecio resedifolius* Lessing, described from a collection of Chamisso's brought back from St. Lawrence Bay on the west side of Bering Straits. Gradually the knowledge of *S. resedifolius* (map 29) increased until, in 1867, Herder recognized it as a wide-ranging species, extending from Bering Straits across arctic Siberia and south to the Altai and along the coast of Alaska to "Brittisch Nord-Amerika." In 1916 its range, as understood by the monographer of the genus, Greenman, was essentially the same. But we now know this beautiful Siberian and Alaskan species from the Long Range of Newfoundland and from subalpine regions of the Shickshock Mts.[1]

Still other plants of these special areas of northeastern America and of western North America are likewise in central Asia, in most cases there quite as isolated from western America as are the plants of Gaspé or of western Newfoundland. *Aster laurentianus* and its allies (map 30), *A. frondosus* of western North America and *A. angustus* of western America, Thibet and Afghanistan, have already been noted. *Erigeron lonchophyllus* (map 18), one of the species selected to illustrate isolation on Anticosti Island, is quite unknown in America from north of latitude 53° but it reappears in the Altai and Baikal regions. *Crepis nana* (map 14), isolated upon the Torngats and, like *Erigeron lonchophyllus*, unknown in British Columbia, and occurring only very locally in Alaska, is known outside North America likewise only in the Baikal and Altai regions of central Asia. *Salix vestita* (map 15), sharing the limestones about the Gulf of St. Lawrence, the Torngats, the Churchill region, the Canadian Rocky Mountains and the Wallowa Mountains is known outside North America only in the Altai[2] and at a single station in eastern Lapland. One of the pondweeds, *Potamogeton loculosus* Hagström, is as yet known only from the Himalayas and from Gaspé County, Quebec. The delicate little fern, *Cryptogramma Stelleri*

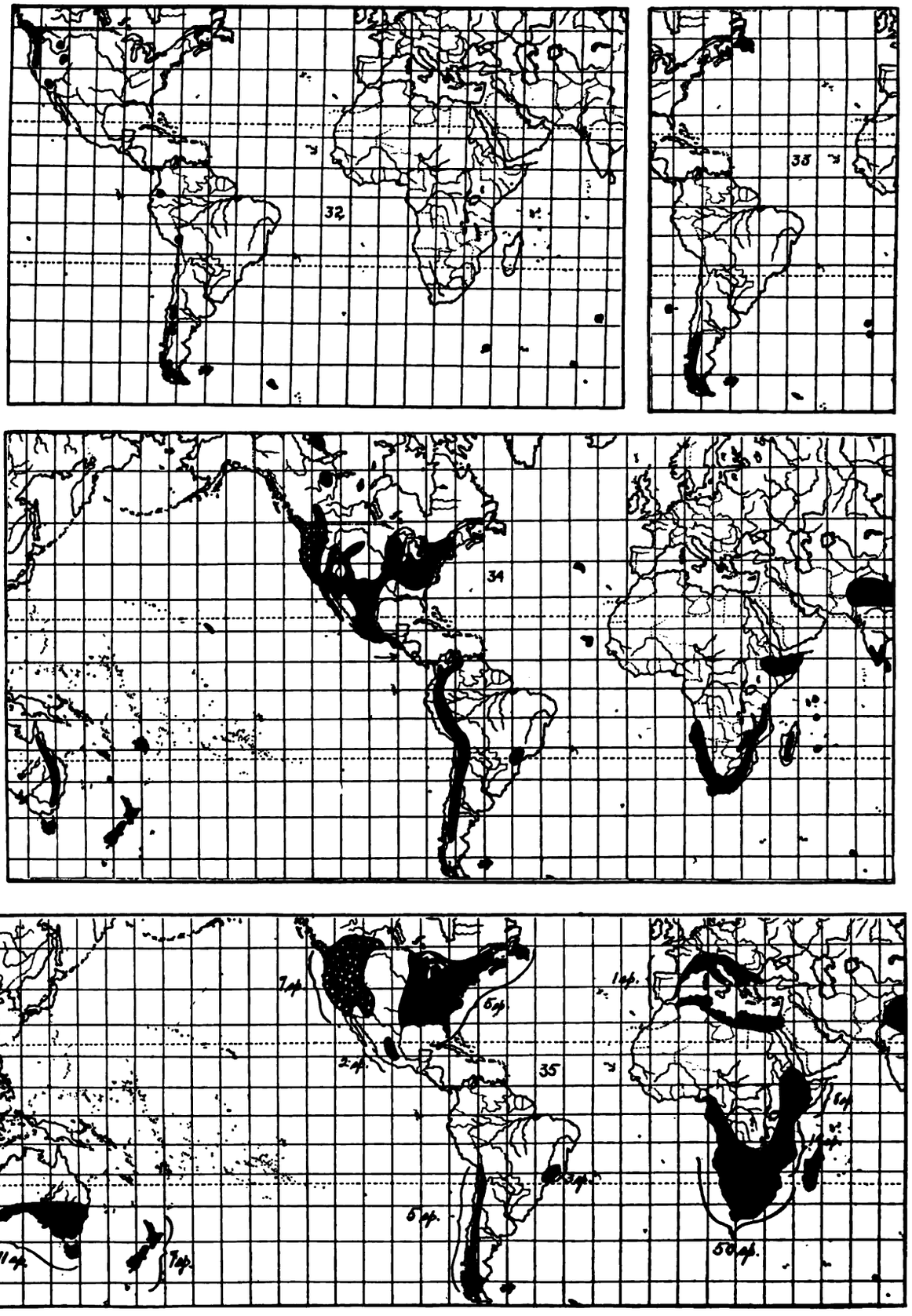
[1] For detailed discussion of *Senecio resedifolius* and its variations and geographic distribution see Fernald, Rhodora, xxvi. 113 (1924).

[2] *S. reticulata*, var. *villosa* Trautv. in Ledeb. Fl. Alt. iv. 201 (1833) is certainly *S. vestita*. Trautvetter so considered it, although treating it as a variety of *S. reticulata;* and Altai material in the Gray Herbarium is matched by American specimens.

(Gmel.) Prantl, is common on calcareous walls about the Gulf of St. Lawrence, thence extending across southern Quebec and northern and western New England to New York and Pennsylvania; it reappears about the Great Lakes and in the Canadian Rockies and is extremely isolated in its other center of distribution, the Altai and Himalayan region. *Arenaria* (*Moehringia*) *macrophylla* Hook. (map 31), a unique species of the subgenus *Moehringia*, is characteristic of sterile rocky slopes or of thin woods of Washington, Oregon and California. It barely crosses the international boundary northward into southern British Columbia and the eastern limit of its continuous range is in northwestern Idaho. It has an isolated small area in southern Colorado; has long been known from Isle St. Ignace in Lake Superior; follows the serpentine and other magnesian rocks through western New England; has three remote stations on the Torngat Mountains and elsewhere on the Labrador Peninsula; and in the summer of 1923 it was found on a dry talus-slope in the Shickshock Mountains of Gaspé. Outside this exceedingly discontinuous American range *Arenaria macrophylla* is known in only one other area, the Altai of central Asia.

One other geographic area to the flora of which plants about the Gulf of St. Lawrence sometimes show close relationship, is cordilleran in the broad sense of the term, but it may seem too remote from western North America for inclusion in the present paper. Reference is made to the Andean region of South America, an area long known to have many plants scarcely separable from species of the southwestern section of the United States. The remarkable fern, *Polystichum mohrioides*, var. *scopulinum* (map 4), with which our illustrations began, may well be recalled as an example of this group of affinities. The first recognized variation of the species, *P. mohrioides* (Bory) Presl, was described by Bory de St.-Vincent from material collected on the Falkland Islands in 1825, during the voyage around the world of the French corvette, La Coquille. Gradually *P. mohrioides* has been found to have an extensive and very characteristic range, one which, with slight modification, can be duplicated in various groups of plants. West of the Falkland Islands it is found on Tierra del Fuego, whence it follows the Andes to southern Chile and very locally to the Quitensian Andes of Ecuador; Skottsberg got it on South Georgia, 800 miles (1290 km.) southeast of the Falklands; Moseley, during the voyage of the Challenger, collected an extreme form of it on Marion Island, 1200 miles (1930 km.) southeast of the Cape of Good Hope and more than 3000 miles (4800 km.) northeast of South Georgia; and the next year De l'Isle discovered it on Amsterdam Island, more than 2000 miles (3200 km.) east of Marion Island. In North America, two varieties are recognized, var. *Lemmoni* (Underwood) Fernald and var. *scopulinum* both confined to arid regions of the Sierra Nevada-Cascade axis, with the exception of four isolated stations for the latter, one each on the Teton, the Mission, the Wasatch and the Shickshock Mountains. In brief, the inclusive species, *Polystichum mohrioides* (map 32), scattered across the border of the Antarctic region and as a very rare and local plant along the cordillera from Cape Horn to Puget Sound and the Teton and Mission Mountains, has its only known station in eastern North America on the Shickshock Mountains of Gaspé.

A somewhat similar distribution (though the plants are absent from western North America) is shown by the red-berried Crowberries of austral regions and of the area centering about the Gulf of St. Lawrence. One of the best known of arctic plants is the Black Crowberry or Curlewberry, *Empetrum nigrum* L. (map 1), widely dispersed in the north polar regions and extending south in America to Newfoundland, Nova Scotia, the Maine coast, the highest mountain-tops of northern New England and northern New York, the tip of Long Island, Pictured Rocks on Lake Superior, the higher mountains of Alberta and British Columbia, Mt. Rainier in Washington, and sea-cliffs of northern California,—a very typical circumpolar range. With the exception of this northern circumpolar species, the only living members of the genus *Empetrum* (map 33) are confined to two remote areas: the region centering on the Gulf of St. Lawrence;



Ranges of (32) *Polystichum mohrioides* and its varieties; (33) *Empetrum rubrum*, southern hemisphere, and *E. atropurpureum* and *E. Eamesii*, eastern North America; (34) genus *Pellaea*, map supplied by Professor F. K. Butters; (35) genus *Danthonia*.

and, 4000 miles (6430 km.) and more to the south, the Andean region from Chile to Tierra del Fuego, Masafuera (the westernmost of the Juan Fernandez group), 500 miles (805 km.) west of Chile, the Falkland Islands and, 2500 miles (4025 km.) east of Patagonia, Gough Island and the islands of the Tristan da Cunha group, about midway between Cape Horn and the Cape of Good Hope. The austral plant, *E. rubrum* Vahl, is at once distinguished from the boreal *E. nigrum* by its white-woolly branchlets, its comparatively broad and blunt leaves which do not become reflexed in age, and by its red, instead of black (very exceptionally purple), berries. Within twenty years after the discovery of *E. rubrum* at the Straits of Magellan, La Pylaie wrote of Newfoundland: "Les points culminans produisent l'Empetrum rubrum, qui n'etait encore comme qu'au detroit de Magellan," [1] and again "Cette plant est indentique avec les echantillons magellaniques conservé dans l'herbier de M. DE JUSSIEU." Grave doubt was expressed by Torrey and other contemporary botanists regarding La Pylaie's discovery but in 1846 Asa Gray settled the matter for the time being at least, by writing: "An examination of Pylaie's herbarium enables me to state that his 'Empetrum rubrum' . . . is very like the Magellanic species," [2] Subsequent exploration and study have shown,[3] however, that, centering about the Gulf of St. Lawrence there are two well defined species with white-woolly branchlets, ascending leaves and red berries: *E. atropurpureum* Fernald & Wiegand of the Magdalen Islands and Prince Edward Island and very locally on the north shore of the lower St. Lawrence, with an outlying area reaching the lesser mountains of Maine and northern New Hampshire; and *E. Eamesii* Fernald & Wiegand, dominant on the Long Range and other mountains of Newfoundland and St. Pierre et Miquelon and the adjacent north side of the Straits of Belle Isle, with an outlying station near the northern tip of Cape Breton. But, although it is possible to distinguish these two plants centering on the Gulf of St. Lawrence, it is very certain that their most obvious characters ally them more closely with the austral *E. rubrum* than with the boreal *E. nigrum*.

Other plants with Andean or Magellanic relationships might be discussed at length, such as *Rumex maritimus*, var. *fueginus* (Phil.) Dusén[4] of Tierra del Fuego and Patagonia; Lower California to British Columbia and the western Great Lake region; and the islands near the outer edge of the submerged continental shelf of northeastern America (Magdalen Islands, Sable Island, Nantucket, Martha's Vineyard and Block Island) with only sporadic stations on the adjacent mainland; but *Polystichum mohrioides* and the red-berried Empetrums sufficiently illustrate this group and fittingly close this series of examples of cordilleran and other western plants isolated about the Gulf of St. Lawrence.

Altogether the cordilleran and other western types localized about the Gulf of St. Lawrence (western Newfoundland, southeastern Labrador, Cape Breton, Anticosti, Gaspé, the Magdalen Islands and Prince Edward Island) and on the Torngat Mountains make up a large element of the flora and the number would be greatly augmented if we should include species which occur both West and East, but which with us range far outside the Gaspé and Newfoundland regions: such plants as *Salix pedicellaris* Pursh, *Geum macrophyllum* Willd., *Viola adunca* Sm., *Heracleum lanatum* Michx., etc. Obviously the plants primarily of West American range cannot be dismissed at once as a part of the circumpolar flora which pushed southward from arctic eastern America to the Gulf of St. Lawrence in front of the advancing Labradorean or Wisconsin ice-sheet.

Even though such an explanation might be urged with some force in the cases of plants belonging to essentially northern groups, it would seem hardly applicable for such species as

[1] La Pylaie, Voyage à l'Isle de Terre-Neuve, 5 (1825).
[2] Gray, Mem. Am. Acad. n.s. iii. 8 (1846).
[3] Fernald & Wiegand, Rhodora, xv. 211–217 (1913).
[4] See St. John, Rhodora, xvii. 81 (1915).

Pellaea densa, *Polystichum mohrioides*, var. *scopulinum* or *Danthonia intermedia*, for all of these are outlying northern representatives of prevailingly austral groups. The *Polystichum*, clearly a phase of *P. mohrioides* (map 32) of the Andes, the Falkland Islands and isolated subantarctic islands, has been sufficiently discussed. The genus *Pellaea* (map 34)[1] has in the eastern hemisphere a fairly typical "Gondwana" range; South Africa, Madagascar and neighboring islands in the Indian Ocean, Somaliland, India, Australia, Tasmania, New Zealand and various Pacific Islands. In Eurasia and northern Africa the genus is unknown outside India and the Himalayan region and the Atlantic islands. In America it follows the cordilleran region from the Andes to southwestern Canada and a few species occur on arid habitats in various parts of the United States, with rare outliers to the north. And even if we accept Maxon's latest verdict, that *Pellaea densa* is really a species of *Cheilanthes*, the case is but slightly changed, for *Cheilanthes* is likewise a genus of wide austral distribution, including Africa and Australia. *Danthonia* (map 35) is certainly a genus which, at least at the present time, is chiefly austral, with 50 species in South Africa, 11 in southern Australia and Tasmania, 7 in New Zealand, 5 in the southern Andes and 3 in Brazil; while in the northern hemisphere there are only 4 in the Himalayas, 1 about the Mediterranean, 2 in Mexico, 6 restricted to western North America, 4 to eastern North America and 1 to western North America and Gaspé and the Long Range.

We are not now concerned with the question, whether these groups, widely dispersed over the southern hemisphere, are of Antarctic origin or whether during the Cretaceous or the Tertiary they made their way from the northern into the southern regions. For the needs of the present discussion it is sufficient to point out, as Skottsberg has already emphasized in regard to similar cases, that the Antarctic dispersal of *Polystichum mohrioides* and *Empetrum rubrum* far antedates the Pleistocene; and since it is reasonable to assume that the dispersal of these types in the northern hemisphere was essentially contemporaneous with their migrations in the southern, it seems reasonable to assert that they did not reach the Gulf of St. Lawrence from the North during the Wisconsin glaciation.

The plants of western North America which have these isolated colonies about the Gulf of St. Lawrence or on the Torngat Mountains include species which in the West are found at widely varying altitudes and in essentially all habitats and they comprise members of the most diverse groups; for instance, ferns, grasses, sedges, rushes, orchids, willows, sandworts, blueberries and composites; *i.e.*, they are highly representative of the vascular flora of northwestern North America; and their isolation about the Gulf of St. Lawrence or on the Torngats, where they are now intimately associated with the so-called "Scandinavian" arctic types which are believed to have pushed southward during the Labrador or Wisconsin glaciation, at once challenges attention.

The maps here published and the statements of some typical ranges make the salient points in the problem clear. But, for the sake of completeness of record, the ranges of the plants isolated upon the mountains and the bleaker coasts of New England, Nova Scotia and the region about the Gulf of St. Lawrence are here appended. In Table I are included the arctic or subarctic species which are isolated or which reach their southern limits upon the alpine and subalpine areas of New England and northeastern New York or on the bleak outer coast from New England to the Gut of Canso (Nova Scotia); in Tables II, III and IV the species, other than those in Table I, which are isolated on the mountains, headlands and coasts centering chiefly on the Gulf of St. Lawrence. For the clearer display of the facts the latter flora is indicated in three tables rather than in a single list. Table II contains the definitely arctic species and differs from Table I merely in the fact that these species (with very few trivial exceptions specially noted in the tables) do not reach New England. Table III contains plants which have sometimes been called

[1] For this map I am indebted to Dr. F. K. Butters.

"circumboreal" rather than circumpolar, species rarely reaching the Arctic in eastern America but which, since they occur or have close relatives to the north of the Gulf of St. Lawrence (in Labrador, Baffinland or Greenland) or in Europe, might have reached their southeastern areas in America along with the polar species of Tables I and II. Table IV, which is the most significant list in the present discussion, contains the species which are neither in arctic eastern America nor ordinarily in Europe, *i.e.*, the plants which can hardly be said obviously to have reached the borders of the Gulf of St. Lawrence in Wisconsin or post-Wisconsin time from arctic eastern America (including Greenland) or to have migrated from Europe around the land which is now submerged by the North Atlantic.

Table I is essentially complete,[1] although the mountains of Maine may eventually yield a few additional species which are now listed in Table II. Tables II, III and IV will be greatly extended as further explorations are made about the Gulf of St. Lawrence and, as the lists now stand, they lack several known species, the identities of which are still awaiting accurate determination, members of such genera as *Cystopteris*, *Poa*, *Deschampsia*, *Eleocharis*, *Carex*, *Cerastium*, *Draba*, *Arabis*, *Amelanchier*, etc. The only other species omitted from the tables are the plants which occur generally in the Canadian forest of the Northeast and which, like the Corn Lily, *Clintonia borealis* (Ait.) Raf., the Twisted Stalk, *Streptopus roseus* Michx., and the Gold Thread, *Coptis trifolia* (L.) Salisb., often venture from below into subalpine meadows or scrub-forest. Such species, being the commonest wide-ranging plants of the Canadian forest, need not be considered in the present study.

In all the tables[2] the latitudes are only approximate, fractions of degrees being uniformly omitted and the nearest complete degrees entered: latitude 49° 47′ as 50, 49° 20′ as 49. Occassionally a seemingly conspicuous violation is done the actual fact, as when a point on Cape Ann in latitude 42° 40′ is entered as 43, a latitude not actually reached by eastern Massachusetts, but

[1] As in the case of the maps every effort has been made to secure accurate data for these tables. Many errors, obviously, must creep in through the inadequacy of trustworthy information; but, although in some cases the ranges will eventually need slight modifications, the tables can be taken as representing the approximate truth.

[2] The geographic abbreviations used are:

ALASK: Alaska. ALB: Alberta. ANTIC: Anticosti Island, Gaspé County, Quebec. ARIZ: Arizona. ATH: Athabasca.

BAF: Baffinland. BC: British Columbia.

CAL: California. C B: Cape Breton Island, the northeastern third of Nova Scotia. COLO: Colorado. , CONN: Connecticut.

ELLES: Ellesmereland.

GASP: the Gaspé Peninsula and adjacent continental region, including the mainland portions of Gaspé County (and Bonaventure Island) and Bonaventure, Matane and Rimouski Counties, Quebec.

LAB: the Labrador Peninsula.

MACK: Mackenzie District of northwestern Canada. MAGD: Magdalen Islands in the middle of the Gulf of St. Lawrence (belonging to Gaspé County, Quebec). MAN: Manitoba. MASS: Massachusetts. ME: Maine. MEX: Mexico. MING: Mingan Islands and adjacent calcareous mainland north of Anticosti. MONT: Montana.

N B: New Brunswick. N C: North Carolina. N DEV: North Devon. NFD: Newfoundland, including St.-Pierre et Miquelon. N H: New Hampshire. N J: New Jersey. N MEX: New Mexico. N S: peninsular Nova Scotia (*i.e.* excluding Cape Breton Island). N Y: New York.

OREG: Oregon.

P E I: Prince Edward Island. PENN: Pennsylvania.

QUE: Province of Quebec, excluding the Magdalen Islands (Magd), the Gaspé region (Gasp), Anticosti (Antic), Mingan (Ming) and the Labrador Peninsula (Lab).

R I: Rhode Island.

SASK: Saskatchewan. S DAK: South Dakota. S I: Sable Island, off eastern Nova Scotia.

VT: Vermont:

WASH: State of Washington. WYO: Wyoming.

YUK: Yukon District of northwestern Canada.

the error is unimportant and negligible in the general averages. The entries in parentheses (except in case of unknown latitudes) are of species so closely related to those in the primary lists as to be clearly their representatives in other regions. Such cases are explained in the footnotes accompanying each table. The strictly or essentially maritime species are indicated by italics.[1]

TABLE I. ARCTIC SPECIES OF NEW ENGLAND

Arctic and subarctic plants reaching their southern limits in eastern America chiefly on alpine or subalpine areas of New England or northern New York, or on the outer coast of peninsular Nova Scotia or of New England.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America[2]	Northern Limit in Greenland[3]	Europe	Asia
Woodsia glabella R. Br.	NY43	Elles79	×	×	Alb51	Mack70	80	×	×
alpina (Bolton) S. F. Gray	NY44	Elles79	×	×	Man53	Mack70	74	×	×
Thelypteris fragrans (L.) Nieuwl.	NH43[4]	Elles82	×	×	BC56	Mack68	78	?	×
Asplenium viride Hudson	Vt43	Elles82	×	×	Wyo43	Alask 61	65	×	×
Lycopodium Selago L.	NC36	Elles82	×	×	Wash 47	Alask70	78	×	×
Sparganium angustifolium Michx.	Penn41	Lab53	×	×	Cal34	Alask57	64	×	×
Festuca supina Schur.	Vt44	Elles76	×		Cal34	BC52		×	×
Poa laxa Haenke	NH44	Baf73	×		Alask60	Alask66	68	×	×
glauca Vahl	NH44	Elles82	×	×	BC50	Yuk69	78	×	×
Agropyron violaceum (Hornem.) Lange	NH44	Elles82	×		Colo38	Alask60	70	×	×
Elymus arenarius, var. *villosus* E. Meyer	NH43	Baf66	×	×	Cal37	Yuk69	72	(×)	×
Deschampsia atropurpurea (Wahl.) Scheele	NH44	Lab57	×		Colo40	Alask60	66	×	×
Calamagrostis hyperborea Lange	NH44	Nfd51	×	×	Cal36	Alask66	68		
neglecta (Ehrh.) Gaertn., Meyer & Scherbius	NH44	Lab54	×	×	Colo39	Alask65	73	×	×
canadensis, var. Langsdorfi (Link) Inman	NH44	Baf67	×	×	NMex35	Alask65	70	×	×
Agrostis borealis Hartman	NC36	Baf66	×		BC52	Alask66	72	×	
Phleum alpinum L.	NH44	Lab60	×		Cal33	Alask58	68	×	×
Hierochloe alpina (Lilj.) R. & S.	NH44	Elles79	×		BC52	Alask66	78	×	×
odorata (L.) Wahlenb.	Conn41	Nfd51	×	×	Ariz34	Yuk64		×	×
od., var. *fragrans* (Willd.) Richter.	NJ39	Lab55	×		Alask66	Alask68		×	×
Scirpus cespitosus, var. callosus Bigelow[5]	NC36	Lab60	×	×	Colo40	Alask65	72	×	×
Eriophorum callitrix Cham.	Penn41	Baf67	×	×	Alask64	Mack68			×
angustifolium Roth	Mass43	Elles82	×	×	NMex36	Alask70	78	×	×
Carex capitata L.	NH44	Lab60	×		Mex20[6]	Alask64	71	×	×

[1] As a matter of historical record it should be stated that, although this paper was completed in the spring of 1924, a few data collected during the summer of 1924 have been inserted during the course of publication.

[2] In the continental arctic area, west of the Arctic Archipelago.

[3] For maps of the distribution of Greenland plants I am indebted to Dr. Morten P. Porsild.

[4] The southern extreme is var. *Hookeriana* Fernald.

[5] *S. cespitosus*, B. *austriacus* (Palla) Aschers. & Graebn. See Fernald, Rhodora, xxiii. 24 (1921).

[6] Also on the southern Andes and Tierra del Fuego.

TABLE I.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
scirpoidea Michx.[1]	Vt43	Baf67	×	×	Colo 39	Mack69	74	×	×
norvegica Willd.	Me43	Lab61	×		Alask57	Alask67		×	×
brunnescens Poir.[2]	NH44	Lab61	×		Colo39	Alask55	67	×	×
concolor R. Br.[3]	NH44	Baf71	×		BC52	Alask70	78	×	×
rariflora (Wahlenb.) Sm.	Me46	Baf66	×		Alask57	Alask70	74	×	×
capillaris L.	NH44	Elles77	×	×	Colo39	Mack65	75	×	×
Juncus trifidus L.[4]	NH43	Lab59	×				72	×	×
Luzula spicata (L.) DC.	NH44	Baf66	×		Ariz35	Alask70	74	×	×
confusa Lindeb.	NH44	Elles83	×		Alask57	Alask71	82	×	×
parviflora (Ehrh.) Desv.	Mass43	Baf66	×	×	Ariz35	Alask68	68	×	×
Orchis rotundifolia Banks	NY43	Ming50	×	×	BC51	Yuk64	61		
Salix Uva-ursi Pursh	NH44	Baf63	×				65		
herbacea L.	NH44	NDev75	×				78	×	×
planifolia Pursh[5]	NH44	Baf63	×		(NMex36)	Mack65		(×)	(×)
argyrocarpa Anderss.	NH44	Lab57	×						
Betula glandulosa Michx.	NH44	Lab60	×		Colo38	Alask70	63		×
papyrifera, var. minor Tuckerman[6]	NH44	Lab60	×				62		
Alnus crispa (Ait.) Pursh	NC36	Lab60	×	×			68		
Oxyria digyna (L.) Hill	NH44	Elles82	×		Cal34	Alask71	82	×	×
Polygonum viviparum L.	NH44	Elles82	×	×	NMex35	Alask70	82	×	×
Arenaria groenlandica Retz.	NH44[7]	Lab60	×				68		
verna, var. pubescens (C. & S.) Fern.[8]	Vt44	Elles83	×		Ariz35	Mack69	72	×	×
Stellaria humifusa Rottb.	Me44	Elles79	×		Oreg44	Alask71	78	×	×
Silene acaulis, var. exscapa (All.) DC.	NH44	Elles82	×		Wyo44	Alask70	78	×	×
Montia lamprosperma Cham.[9]	Me44	Lab60	×		Alask54	Alask67	71	×	×
Ranunculus Cymbalaria Pursh	NJ38	Lab54	×	×	Mex19[10]	Mack68	64	×	×
Subularia aquatica L.	NH43	Lab52	×		Cal38	Alask60	67	×	×
Cardamine bellidifolia L.	NH44	Elles82	×		Oreg45	Alask65	78	×	×
Draba stylaris J. Gay	Vt44	Lab59	×		Colo39	BC55	?	×	
Sedum roseum Scopoli	Penn40	Lab60	×		BC53	Alask70	75	×	×
Saxifraga rivularis L.	NH44	Elles82	×		Wyo43	Alask72	83	×	×
stellaris, var. comosa Retz.	Me46	Elles82			Colo40	Alask57	83	×	×

[1] Including *C. pseudoscirpoidea* Rydb. and other recently proposed cordilleran segregates. A single European locality, in arctic Norway.

[2] At low altitudes and much farther south as var. *sphaerostachya* (Dewey) Kükenth.

[3] *C. rigida* Gooden., not Schrank.

[4] Var. *monanthos* (Jacq.) Bluff & Fingerh. occurs from New Hampshire to North Carolina.

[5] *S. chlorophylla* Anderss. Too close to the Eurasian *S. phylicifolia* L.

[6] Inseparable from the Greenland shrub known as *B. odorata*, var. *alpestris*. They may constitute a distinct boreal American species.

[7] Var. *glabra* (Michx.) Fernald extends from low altitudes in New England to Georgia.

[8] *A. propinqua* Richardson; *A. hirta* Wormskj.

[9] Widely dispersed in Antarctic regions.

[10] Also in the Andes.

TABLE I.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
aizoides L.[1]	Vt44	Elles77	×	×	Alb51	Mack70	78	×	
Aizoon Jacq.	Vt44	Baf73	×	×			75	×	
oppositifolia L.	Vt44	Elles83	×		Mont47	Alask70	85	×	×
Sibbaldia procumbens L.	NH44	Lab59	×		Cal36	Alask60	74	×	×
Potentilla tridentata Ait.	NC36	Baf66	×	×			69		
Robbinsiana Oakes[2]	NH44	NH44						(×)	
Geum Peckii Pursh.	NH44	NH44							
Rubus Chamaemorus L.	NH44[3]	Lab60	×		Man53	Mack70	64	×	×
Lathyrus maritimus (L.) Big.	NJ39	Lab58	×		Alask52	Yuk69	62	×	×
marit., var. *glaber* (Seringe) Eames	NY41	Nfd50	×	×	Cal41	Alask60		×	×
Empetrum nigrum L.	NH44[4]	Elles79	×	×	Cal42	Alask72	80	×	×
Viola palustris L.[5]	NH44	Lab58	×		Colo39	Alask60	67	×	×
labradorica Schrank	NH44	Lab60	×	×	BC51	BC52	67		
Epilobium lactiflorum Haussk.[6]	NH44	Lab54	×		Colo37	Yuk62	71	×	×
alpinum L.[7]	Me46	Lab60	×		Cal37	Alask65	73	×	×
Hornemanni Reichenb.	NH44	Lab58	×		Cal38	Yuk62	70	×	×
palustre, var. labradoricum Haussk.	NH44	Lab59	×				69		
Ligusticum scothicum L.	NY41	Lab56	×		Alask52	Alask67	66	×	×
Rhododendron lapponicum (L.) Wahlenb.	NH44	Baf71	×	×	Alb56	Alask71	77	×	(×)
Loiseleuria procumbens (L.) Desv.	NH44	Baf67	×		Alb54	Mack70	74	×	×
Phyllodoce caerulea (L.) Bab.	NH44	Baf67	×		Alask62	Alask62	74	×	×
Cassiope hypnoides (L.) D. Don.	NH44	Baf71	×				74	×	×

[1] Including *S. Van-Bruntiae* Small.

[2] Closely related to *P. frigida* Vill. of alpine Europe. See Th. Wolf, Mon. Gatt. Pot. 531 (1908).

[3] A casual colony on Long Island seems not to have persisted.

[4] A small colony isolated at the tip of Long Island.

[5] It is impossible at the present time to determine the exact limits in the West of *V. palustris*. This arises from the fact that much of the material from the Pacific slope is *V. epipsila* Ledeb. and that records from British Columbia and Alaska cannot be accepted without careful verification. *V. palustris* has the reniform-orbicular leaves rounded at summit, the vernal flowers with broad obovate petals 0.6—rarely 1 cm. long, the thick style not at all or only slightly exserted beyond the anthers. *V. epipsila*, a characteristic Eurasian species, has the later leaves ovate or ovate-orbicular and short-acuminate, the narrowly obovate or oblong petals mostly 1–1.7 cm. long and the slender style exserted about 1 mm. beyond the anthers. In western as in eastern America *V. palustris* is an alpine and subalpine species, *V. epipsila* in the West often occurring at low altitudes. The latter species has been described from British Columbia as *V. cyclophylla* Greene, Pittonia, iv. 7 (1899), the name later changed to *V. eucycla* Greene, Pittonia, v. 88 (1902) because of *V. cyclophylla* Gandoger (1875).

The following are characteristic specimens of *V. epipsila*. IDAHO: marshes near Granite Station, Kootenay Co., *Sandberg, MacDougal & Heller*, no. 793. OREGON: marshes near Mt. Hood, *J. Howell*. WASHINGTON: alpine meadow, Mt. Paddo, *Suksdorf;* swamp, Roy, *O. D. Allen*, no. 76; swamps, upper Valley of Nesqually, *O. D. Allen*, no. 57; bank of Trout Creek, Klikitat Co., *Suksdorf*. BRITISH COLUMBIA: Chilliwack Valley, *J. M. Macoun*, no. 33,943; Harrison, Fraser Valley, *Spreadborough*, no. 63,525. ALASKA: Lituya Bay, *M. Baker;* grassy slope, Wrangell, *Walker*, no. 619; wet meadows, Yakutat, *Walker*, no. 1049; Silver Bow Basin, Juneau, *Cooley*.

[6] *E. alpinum* of Gray's Man., ed. 7, not L.

[7] *E. anagallidifolium* Lam.

TABLE I.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Arctostaphylos alpina (L.) Spreng..	NH44	NDev77	×		Alask54	Yuk69	74	×	×
Vaccinium uliginosum, var. alpinum Bigelow	NH44	Elles79	×	(×)	BC50	Mack69	78	(×)	×
pennsylvanicum, var. angustifolium (Ait.) Gray	NH44[1]	Lab56	×						
Vitis-Idaea, var. minus Lodd.	Mass 43	Baf68	×	×	Alask56	Alask72	70	×	×
Diapensia lapponica L.	NH44	Elles82	×		Alask63	Alask65	75	×	×
Primula mistassinica Michx.	Me44	Nfd51	×	×	Sask52	Alask64	72		
Mertensia maritima (L.) S. F. Gray.	Mass41	Baf67	×		Alask52	Alask71	73	×	×
Veronica alpina, var. unalaschensis C. & S.	NH44	Lab61	×		Ariz35	Alask67	75	×	×
Euphrasia Williamsii Robinson	NH44	NH44							
Rhinanthus borealis (Sterneck) Chabert[2]	NH44	Lab59	×		Alask52	Alask60	67	×	
Pinguicula vulgaris L.	NH44	Lab59	×	×	Wash47	Mack66	71	×	×
Plantago decipiens Barneoud	RI40	Lab56	×				72	×	
Gnaphalium supinum L.	NH44	Lab58	×				70	×	
Achillea Millefolium, var. nigrescens E. Meyer[3]	NH44	Lab60	×		Colo37	Yuk69	64	×	×
Prenanthes Boottii (DC.) Gray	NH44	Me46							

TABLE II. ARCTIC SPECIES CENTERING SOUTHEASTWARD ON THE GULF OF ST. LAWRENCE

Arctic plants with their southern limits in eastern America chiefly in the region bordering the Gulf of St. Lawrence.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Polystichum Lonchitis (L.) Roth.	CB46	Nfd50	×	×	Colo38	Alask63	69	×	×
Botrychium Lunaria (L.) Sw.	Vt44	Lab52	×	×	Cal34	Alask66	73	×	×
lanceolatum (Gmel.) Angstr.	Gasp49	Lab50	×		Colo39	Alask59	68	×	×
Lycopodium alpinum L.	Gasp49	Baf72	×		Mont49	Yuk64	76	×	×
Juniperus communis, var. montana Ait.	Nfd47	Lab58	×		NMex35	Alask56	68	×	×
Sparganium hyperboreum Laest.	CB46	Lab54	×		Idaho44	Alask54	68	×	×
Festuca vivipara (L.) Sm.	Nfd49	Lab52	×				75	×	×

[1] More southern stations are reported but they are presumably of narrow-leaved forms of the larger-flowered typical *V. pennsylvanicum*.

[2] *R. oblongifolius* Fernald is probably referable to *R. borealis*.

[3] Including *A. borealis* Bong. and *A. nigrescens* (E. Meyer) Rydberg.

TABLE II.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
rubra, var. arenaria (Osbeck) Fries	Nfd48	Nfd49	×		Sask53	Alask66	70	×	×
Puccinellia coarctata Fern. & Weath.[1]	Nfd47	Lab52	×				(78)		
Poa alpina L.	CB47	Baf73	×	×	Colo37	Alask67	74	×	×
Trisetum spicatum, var. Maidenii (Gandoger) Fernald	Nfd48	Elles82	×		BC52	Yuk69	80	×	×
Calamagrostis purpurascens R. Br.	Gasp48	Gasp48	×		Cal38	Mack68	74		
Eriophorum Scheuchzeri Hoppe	Nfd51	Elles82	×		Alask56	Mack70	82	×	×
Kobresia simpliciuscula (Wahlenb.) Mackenz.[2]	Nfd48	Elles76	×		Colo40	Alask64	77	×	×
Carex nardina Fries[3]	Gasp49	Elles82	×		(Colo39)	(BC51)	81	×	×
incurva Lightf.	Nfd51	Elles82	×		Mack65[4]	Alask71	74	×	×
rupestris All.	Nfd48	Elles79	×		Colo39	Mack69	77	×	×
microglochin Wahlenb.[5]	Ming50	Lab53	×		Colo39	BC52	72	×	×
Macloviana D'Urv.[4]	Gasp49	Lab59	×		Oreg42	Mack65	72	×	×
bipartita All[6]	Gasp49	Baf67	×		BC50	Alask57	73	×	×
glareosa Wahlenb.	NB47	Elles79	×		Alask55	Alask65	78	×	×
bicolor All.[7]	Nfd51	Lab(?)	×				71	×	×
subspathacea Wormskj.	Gasp49	Lab51	×		Alask55	Alask70	71	×	×
Halleri Gunn.	NB47	Baf66	×	×	Colo38	Yuk64	72	×	×
glacialis Mackenz.	Nfd48	Elles79	×		Alask59	Yuk64	73	×	×
Juncus albescens (Lange) Fernald[8]	Nfd48	Lab58	×		Colo39	Mack69	72	(×)	(×)
castaneus Sm.	Gasp49	Baf66	×		Colo40	Alask66	72	×	×
Luzula campestris, var. alpina Gaudin[9]	Gasp49	Baf66	×				70	×	×
Tofieldia minima (Hill) Druce	Nfd48	Baf71	×	×	BC51	Mack69	74	×	×
Salix reticulata L.	Nfd51	Baf73	×		Alask52	Alask70		×	×
arctophila Cockerell	Nfd48	Baf64	×				77		
Polygonum boreale (Lange) Small	Nfd49	Lab57	×				70	×	
Sagina saginoides (L.) Dalla Torre	Gasp49	Baf63	×		Cal34	Alask66	73	×	×
Stellaria longipes Goldie	Que46	Elles82	×	×	Cal34	Alask70	82	×	×
Arenaria sajanensis Willd.	Gasp49	Baf67	×		Ariz35	Alb52	77	×	×
peploides L.[10]	Magd47	Baf67	×		Alask52	Alask70	78	×	×
Cerastium alpinum L.	Nfd51	Elles83	×		Alask66	Alask72	83	×	×
cerastioides (L.) Britton	Gasp49	Lab62	×				73	×	×
Lychnis alpinaL.	Nfd48	Lab61	×				72	×	×

[1] Representative of *P. vaginata* (Lange) Fern. & Weath. of Greenland.

[2] *K. caricina* Willd. See Mackenzie, Bull. Torr. Bot. Cl. l. 349 (1923).

[3] Represented in the Rocky Mts. by the closely similar *C. Hepburnii* Boott.

[4] Also in the Chilean region.

[5] A geographic variety found also in Tierra del Fuego.

[6] *C. Lachenalii* Schkuhr. See Mackenzie, Bull. Torr. Bot. Cl. l. 348 (1923). An isolated station reported in New Zealand.

[7] The plant treated in Gray's Manual, ed. 7, as *C. bicolor* is chiefly *C. Hassei* Bailey.

[8] American representative of the Eurasian *J. triglumis* L. See Fernald, Rhodora, xxiv. 202 (1924).

[9] *L. sudetica* (Willd.) DC.

[10] Var. *robusta* Fernald south to New Jersey; var. *major* Hook. south to Oregon.

TABLE II.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Ranunculus hyperboreus Rottb.	Ming50	Elles79	×		Alb52	Yuk69	77	×	×
pygmaeus Wahlenb	Gasp49	Elles79	×		Wyo43	Alask71	78	×	×
Thalictrum alpinum L.	Nfd48	Lab52	×		Cal38	Alask67	73	×	×
Lesquerella arctica (Wormskj.) Wats.	Nfd48	Elles82	×		Alb53	Mack69	83		
Draba fladnizensis Wulf.[1]	Gasp49	Elles83	×		Colo39	Alask70		×	×
arctica Vahl	Gasp49	Elles83	×				82		
nivalis Lilj	Gasp49	Elles79	×		Colo39	Mack71	83	×	
aurea Vahl	Gasp48	Lab59	×		Colo39	Alb54	71		
incana L.	Magd47	Lab59	×	×	Alask(?)	Alask(?)	70	×	×
hirta L.	Gasp48	Baf71	×		Alask(?)	Yuk69		×	×
rupestris R.Br.[2]	CB47	Elles76	×		Alask(?)	Alask(?)		×	×
Arabis alpina L.	Gasp48	Baf67	×				74	×	×
Holboellii Hornem.[3]	Gasp48	Gasp48	×	?	?	?	72		
Braya purpurascens (R.Br.) Bunge.	Nfd51	Elles82	×		Alb52	Mack70	78	×	×
Sedum villosum L.	Lab51	Lab51	×				71	×	
Saxifraga cernua L.	Gasp49	Elles82	×		Colo39	Mack71	83	×	×
cespitosa L.	Gasp48	Elles83	×		Colo39	Alask70	83	×	×
Potentilla nivea L.	Gasp48	Baf72	×		Colo39	Alask70	81	×	×
alpestris Hall.f.	Nfd48	Baf67	×				74	×	×
Dryas integrifolia Vahl	Nfd48	Elles83	×		Alb51	Alask72	83		×
Astragalus alpinus L.	Nfd49	Baf73[4]	×		NMex36	Alask72		×	×
Epilobium latifolium L.	Gasp48	Elles82	×		Colo38	Alask70	82	×	×
angustifolium, var. intermedium (Wormskj.) Fernald	Gasp49	Baf66	×				70		
Hippuris vulgaris, var. *maritima* Hartm.	Gasp49	Lab60	×		Alask55	Alask70	73	×	×
Pyrola grandiflora Radius	Nfd48	Elles79	×		Mack60	Alask70	78		×
Arctostaphylos Uva-ursi (L.) Spreng.	Gasp48[5]	Nfd51	×	×	NMex35	Alask59	68	×	×
Statice labradorica (Wallr.) Hubbard & Blake	Nfd51	Lab59	×				?		
lab., var. submutica Blake	Gasp49	Baf67	×				78		
Androsace septentrionalis L.	Gasp49	Elles82	×		NMex36	Yuk67		×	×
Lomatogonium rotatum (L.) Fries	Magd47	Lab55	×		Colo39	Mack67	69	×	×
Euphrasia arctica Lange	Gasp48	Baf66	×	×			74	×	
Pedicularis flammea L.	Gasp49	Baf68	×		Alb50	Alb53	75	×	
Campanula uniflora L.	Gasp49	Elles79	×		Colo39	Mack69	78	×	×
Erigeron compositus Pursh[6]	Gasp49	Elles82	×		Cal36	Mack69	82		

[1] The Shickshock plants included under *D. fladnizensis* may prove to be more than one species.

[2] Ledebour cites *D. rupestris* from Alaska. I have seen no material; and the identification of the plant of Cape Breton, Gaspé and Newfoundland is not beyond question.

[3] The plant at Bic is apparently identical with the true Greenland *A. Holboellii*. A mass of cordilleran material passes under this name, but until it can be thoroughly studied it would be unwise to attempt delimiting the western species.

[4] Var. *Brunetianus* Fernald (*A. labradoricus* DC.) on river-gravels to Vt43.

[5] The common plant of lower latitudes in eastern America is var. *coactilis* Fern. & Macbr.

[6] The plant of eastern America, including Greenland, belongs to var. *multifidus* (Rydb.) Macbr. & Payson, which differs from the typical form of the species only in its more hirsute leaves.

TABLE II.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Gnaphalium norvegicum Gunn.....	Gasp49	Baf72	×				69	×	×
Artemisia borealis Pall.....	Nfd48	Baf66	×		Colo39	Alask68	72	×	×
Senecio palustris (L.) Hook., var. congestus (R. Br.) Hook.....	Lab51	Baf73	×	×	Sask52	Alask70			×
Taraxacum lapponicum Kihlm.....	Gasp48[1]	Lab62	×		NMex36	Mack70	72	×	×
ceratophorum (Ledeb.) DC.....	Gasp48[1]	Baf68	×		NMex36	Yuk70	72	×	×

TABLE III. BOREAL OR EUROPEAN SPECIES CENTERING ON THE GULF OF ST. LAWRENCE

Boreal, but scarcely Arctic, or European plants with their southern limits in eastern America chiefly in the region bordering the Gulf of St. Lawrence.

Cystopteris montana (Lam.) Bernh.	Gasp49	Lab59	×	×	Colo39	Alask66		×	×
Thelypteris Filix-mas (L.) Nieuw.[2]..	Vt43	Nfd50	×	×	Ariz32	Alask57	62	×	×
Robertiana (Hoffm.) Slosson.....	NB48	Ming50	×	×	Yuk64	Yuk64		×	×
Selaginella selaginoides (L.) Link...	CB46	Lab50	×	×	BC49	Alask54	65	×	×
Ruppia maritima, var. *obliqua* (Schur) Aschers & Graeb.[3].....	PEI46	Gasp49	×					×	
marit., var. *intermedia* (Thed.) Aschers. & Graebn.[4].....	Gasp48	Gasp48	×		Wash48	Wash48		×	
marit., var. *brevirostris* Agardh[5] ..	Magd48	Magd48	×					×	
Agropyron pungens (Pers.) R. & S. .	Mass42	CB47	×					×	
Catabrosa aquatica (L.) Beauv.[6]	PEI46	Lab52	×		Colo38	Alask56		×	×
Scirpus rufus (Huds.) Schrad.....	NS44[7]	Nfd51	×		Man53	Man53		×	×
Eriophorum Chamissonis C. A. Meyer.....	NS46	Lab57	×	×	Wyo44	Alask56		×	×
opacum (Bjornstr.) Fernald.....	Nfd51[8]	Nfd51	×	×	Alb51	Yuk64		×	×
Carex chordorrhiza, var. sphagnicola Laestad.....	Nfd51	Nfd51	×					×	

[1] The record from "Massachusetts" in Sherff's *North American Taraxacum*, Bot. Gaz. lxx. 339 (1920) goes back to Handel-Mazzetti's citation under *T. lapponicum* Kihlm. of a specimen from "Prov. Massachuset (Robbin)." This reference was doubtless taken from one of Robbins's well known labels in which his name and address, at Uxbridge, Massachusetts, are conspicuously printed, the really important data in regard to the specimens being insignificant and often overlooked. The southern range of *T. ceratophorum* in eastern America seems to be on the cliffs west of Bic in Rimouski County, Quebec, and of *T. lapponicum* in the river-gravels of the Gaspé Peninsula. A young individual (apparently referable to *T. lapponicum*) was collected at an elevation of 4500 feet in King's Ravine on Mt. Adams, New Hampshire in 1903, presumably a casual individual derived from a chance seed wafted from the Gaspé region, where the plant abounds. "In spite of several searches made since that time no more plants have been discovered."—A. S. Pease, Rhodora, xix. 112 (1917).

[2] The Vermont stations are not subalpine, therefore this species belongs in Table III.

[3] *R. obliqua* Schur.

[4] *R. intermedia* Thedenius.

[5] *R. brachypus* Gay.

[6] Dr. Porsild informs me that at the Greenland station the plant was introduced by man.

[7] The isolated station at Yarmouth, Nova Scotia, is the only one known southwest of Cape Breton and the shores of the Gulf of St. Lawrence.

[8] Recorded from New England through error of determination.

TABLE III.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
muricata L.[1]	Nfd49	Lab52	×		BC51	Alask53		×	×
pratensis Drejer[2]	Gasp48	Lab52	×	×	Colo40	Yuk63	67		
maritima O. F. Muell	Mass42	Lab54	×					×	
salina Wahlenb	Que48	Lab52	×		Alask(?)	Alask(?)	61	×	
sal., var. *kattegatensis* (Fries) Almquist	Mass42	Lab58	×					×	
stylosa C. A. Meyer	Nfd48	Lab60	×		Alask54	Alask58	62	×	×
Hostiana, var. laurentiana Fernald & Wiegand[3]	Nfd47	Nfd51	×					(×)	
lepidocarpa Tausch	Magd47	Nfd51	×					×	
Oederi, var. subglobosa (Mielich.) Richter	Nfd51	Nfd51	×					×	
Juncus *bufonius*, var. *halophilus* Buchenau & Fernald	Conn41	Lab52	×		Cal39	Wyo41		×	
alpinus Vill	Gasp48[4]	Nfd51	×		Colo39	Alb52		×	×
stygius, var. americanus Buchenau	Me45	Lab51	×	×	Alask55	Alask57		×	
Luzula campestris, var. pallescens Wahlenb.[5]	Gasp48	Nfd49	×					×	×
camp., var. congesta (Thuill.) Meyer	Nfd48	Nfd48	×		Cal34	BC50		×	×
Habenaria viridis (L.) R. Br	Nfd51	Nfd51	×					×	×
Salix cordifolia Pursh	Gasp49	Lab59	×				67		
Polygonum Raii Babington	NS44	Nfd49	×					×	
acadiense Fernald	CB46	CB46	×					×	
Atriplex maritima Hallier	PEI46	NB48	×					×	
glabriuscula Edmonston	RI42	Lab52	×				62	×	
Salicornia europaea, var. *prostrata* (Pallas) Fern	Me44	Antic49	×		Sask50	Sask50		×	×
Sagina nodosa (L.) Fenzl	Mass42	Lab51	×	×			61	×	×
Stellaria crassifolia Ehrh	PEI46	Lab55	×		Colo39	Alask57		×	×
Montia rivularis Gmel	NB47	Nfd48	×					×	
Braya humilis (C. A. Meyer) Rob.	Nfd48[6]	Antic49	×		BC50	Alask(?)	67		×
Barbarea orthoceras Ledeb	NH44	Lab56	×		Ariz34	Alask64		×	×
Drosera anglica Hudson	Gasp48	Lab53	×	×	Cal39	Alask55		×	×
Parnassia palustris L	Nfd51	Lab58	×	×	Cal38	Yuk69		×	×
Kotzebuei Cham. & Schl	Gasp48	Lab59	×		BC51	Yuk69	61		×
Potentilla Anserina L	Vt44	Nfd50	×	×	Cal34	Alask(?)		×	×

[1] The typical Eurasian *C. muricata* L. = *C. echinata* Murr. and *C. stellulata* Good. For discussion of the nomenclature see Mackenzie, Bull. Torr. Bot. Cl. l. 346 (1923).

[2] The Nova Scotian plant recorded as *C. pratensis* is *C. hormathodes* Fern.; the Maine plant is too young for final determination.

[3] *C. fulvescens* Mackenzie. Distinguished from the European *C. Hostiana* DC. only by its slightly larger size in all parts. Once collected in eastern Massachusetts but never rediscovered there.

[4] Varieties extending farther south.

[5] *L. pallescens* (Wahlenb.) Besser.

[6] Var. *novae-angliae* (Rydb.) Fernald to Vt 44.

TABLE III.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Alchemilla vulgaris, var. filicaulis (Buser) Fern. & Wieg.[1]	Nfd48	Lab52	×				68	×	
vulg., var. vestita (Buser) Fern. & Wieg.[2]	Nfd51	Lab52	×					×	
vulg., var. grandis Blytt[3]	Gasp48	Lab52	×					×	
Rubus arcticus L.	Gasp48	Lab52	×		Alb50	Alask69		×	×
Oxytropis campestris, var. caerulea Koch	Gasp48[4]	Lab61	×					×	(×)
Myriophyllum verticillatum, var. intermedium Koch	Magd48	Magd48	×					×	
Cornus suecica L.	Magd47	Lab52	×		Alask52	Alask67	66	×	×
Primula farinosa L.	Nfd51	Lab59	×					×	×
egaliksensis Wormskj.	Nfd51	Lab60	×				62		
Glaux maritima L.	Mass42	NB48	×		NMex36	Alb50		×	×
Centunculus minimus L.	SI44[5]	PEI47	×		Mex27	Sask53		×	×
Gentiana Amarella L.	Vt44	Lab53	×		Ariz32	Alask60		×	×
Limosella aquatica L.[6]	Nfd48	Lab53	×		Mex19[7]	Alb53		×	×
Euphrasia canadensis Towns[8]	NS43	Gasp49	×					(×)	
stricta, var. tatarica (Fisch.) Fern. & Wieg.	Gasp48	Lab50	×					×	×
americana Wettstein[9]	NS43	Nfd51	×					(×)	
Pedicularis palustris L.[10]	Magd47	Gasp49	×		(Man56)	(Alask66)		×	(×)
Solidago macrophylla, var. thyrsoidea (E. Meyer) Fern.[11]	NH44	Lab60	×	(×)				(×)	
Erigeron acris, var. asteroides (Andrz.) DC.	Me46	Lab53	×	×	Colo39	Alask60		×	×
Gnaphalium sylvaticum L.[12]	NH44	Nfd49	×					×	
Hieracium smolandicum Almq.	NH45	Gasp49	×					×	

[1] *A. filicaulis* Buser.

[2] *A. minor* Hudson.

[3] *A. alpestris* Schmidt.

[4] The large var. *johannensis* Fernald to NB46.

[5] Another eastern area from southern Georgia and Florida to South America.

[6] The quite distinct American *L. subulata* Ives follows the coast from the Gulf of St. Lawrence southward to the lower Delaware.

[7] Also in the Andes.

[8] Very close to the European *E. nemorosa* Pers.

[9] Closely related to the European *E. stricta* Host.

[10] Closely related to *P. parviflora* Sm. of northwestern America and Siberia.

[11] *S. macrophylla*, var. *thyrsoidea* is closely approached by the European *S. alpestris* Waldst. & Kitaibel.

[12] Perhaps introduced; occurs about clearings and other semi-cultivated areas.

TABLE IV. WESTERN AND ENDEMIC SPECIES CENTERING ON THE GULF OF ST. LAWRENCE

Plants, found in neither Arctic nor Subarctic eastern America nor in Europe, centering on the region bordering the Gulf of St. Lawrence; but in a few cases extending to the coast or mountains of New England.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Woodsia oregana D. C. Eaton[1]	Gasp48	Gasp48	×	×	Cal34	Alb52			
scopulina D. C. Eaton[2]	Gasp49	Gasp49	×	×	Cal34	Alask60			
ilvensis, var. gracilis Lawson	Vt45	Gasp49	×						
Polystichum mohrioides, var. scopulinum (D. C. Eaton) Fern.[3]	Gasp49	Gasp49	×		Cal34	BC50			
Athyrium alpestre, var. americanum Butters[4]	Gasp49	Gasp49	×		Cal36	Alask57	(61)	(×)	
Filix-femina, var. sitchense Ruprecht[5]	Gasp49	Gasp49	×		Cal36	Alask60		(×)	(×)
angustum, var. laurentianum Butters	Me45	Lab55	×						
Pellaea densa (Brack.) Hook.[6]	Que46	Gasp49	×	×	Cal36[7]	BC51			
Adiantum pedatum, var. aleuticum Ruprecht[8]	Vt45	Nfd51	×		Cal34	Alask59			×
Pteridium aquilinum, var. lanuginosum Bory	Que46	Gasp49	×	×	Mex15	Alask59		(×)	(×)
Botrychium virginianum (L.) Sw., var. laurentianum Butters	Me45	Lab52	×	×					
Equisetum palustre, var. nigridens St. John	Lab50	Lab50	×						
Lycopodium sabinaefolium Willd.[9]	NH43	Lab53	×	×	Oreg45	Alask59			
Isoetes macrospora Durieu	NY42	Gasp49	×	×					
Abies balsamea, var. phanerolepis Fernald	Me44	Nfd50	×						
Juniperus horizontalis Moench	Vt43	Lab53	×	×	Colo38	BC52			
communis, var. megistocarpa Fernald & St. John	SI44	Nfd51	×						
Potamogeton loculosus Hagstr.	Gasp49	Gasp49	×						×
filiformis, var. Macounii Morong[10]	PEI46	Magd48	×		Cal38	Alb58			
Ruppia maritima, var. *subcapitata* Fern. & Wieg.	Mass41	Lab51	×						
Festuca scabrella Torr.[11]	Que46	Nfd50	×		Colo39	BC52			(×)
Puccinellia macra Fern. & Weath.[12]	Gasp49	Gasp49	×		(Cal37)	(BC50)			
laurentiana Fern. & Weath.[12]	NB47	Gasp49	×		(Cal37)	(BC50)			

[1] See p. 252 and map 17. [2] See p. 250 and map 9. [3] See p. 247 and map 4.

[4] Perhaps specifically separable from the European *A. alpestre* as *A. americanum* (Butters) Maxon.

[5] Geographic variety of a Eurasian species. [6] See p. 249 and map 8.

[7] An extreme southern station in Costa Rica, latitude about 10°.

[8] See p. 260.

[9] Including *L. sitchense* Ruprecht. See Fernald, Rhodora, xxv. 166 (1923).

[10] See p. 258 and map 27.

[11] Sometimes confused with the Asiatic and Alaskan *F. altaica* Trin. See p. 249 and map 7.

[12] Eastern representative of the Pacific coast *P. nutkaensis* (Presl) Fern. & Weath. See pp. 258 and map 26.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
lucida Fern. & Weath.[1]	Que47	Gasp48	×		Cal38	BC49			
paupercula (Holm) Fern. & Weath.	Magd48	Lab63	×		(Cal39)	(Alask57)			
paup., var. *alaskana* (Scrib. & Merr.) Fern. & Weath.	Conn41	Nfd51	×		Cal39	Alask57			
paup., var. *longiglumis* Fern. & Weath.	PEI46	PEI46	×		(Cal39)	(Alask57)			
Poa eminens J. S. Presl	Magd47	Lab56	×		BC49	Alask67			×
Sandbergi Vasey	Gasp48	Gasp49	×		Cal34	BC51			
Agropyron tenerum Vasey	Conn42	Nfd51	×	×	Ariz35	BC51			
Hordeum boreale Scrib. & Sm.[2]	Nfd50	Lab52	×		Cal39	Alask60			×
Danthonia intermedia Vasey[3]	Gasp49	Nfd50	×		Cal34	Alb53			
Trisetum melicoides (Michx.) Vasey[4]	Vt44	Antic50	×	×	(Cal36)	(Mont48)			
spicatum, var. pilosiglume Fernald	NH44	Lab59	×	×	(Cal34)	(Yuk69)	(×)	(×)	(×)
Calamagrostis canadensis, var. robusta Vasey	NH44	Lab51	×	×	NMex35	Alb52			
Agrostis idahoensis Nash	Gasp49	Gasp49	×		Cal34	Alb53			
melaleuca (Trin.) Hitchc.	Nfd51	Nfd51	×		Colo39	Alask59			
hyemalis, var. geminata (Trin.) Hitchc	Gasp48	Nfd52	×		Cal35	Alask58			
Muhlenbergia Richardsonis (Trin.) Rydb.[5]	NB46	Antic50	×		NMex35	Sask52			
Eleocharis nitida Fernald	NS45	Nfd50	×						
Scirpus Clintonii Gray	Me45	Gasp48	×	×					
Carex cumulata (Bailey) Mackenz.	Penn41	NB48	×	×	Man49	Man51			
adusta Boott	Me44	Nfd49	×	×	Sask50	Mack(?)			
Deweyana, var. collectanea Fern.	Gasp48	Gasp49	×						
lenticularis, var. albimontana Dewey	NH44	Gasp49	×						
scopulorum Holm	Gasp49	Gasp49	×		Cal36	Mont48			
atratiformis Britton	NH44	Lab52	×	×	Alb51	Yuk64			
concinna R. Br.	NB48	Lab52	×		Colo39	Mack65			
Hassei Bailey	NB46	Lab52	×	×	Cal34	Yuk64			
gracillima, var. macerrima Fern. & Wiegand	Nfd49	Nfd49	×						
misandroides Fernald[6]	Nfd48	Gasp49	×		(Alb51)	(Alb56)			
Backii Boott	Mass42	Gasp49	×	×	Alb51	Alb51			
flava, var. gaspensis Fern.	Vt44	Nfd49	×						
Michauxiana Boeckl	Vt43	Lab52	×	×					×
miliaris Michx.	NB45	Lab53	×		BC49	BC50			
mil., var. major Bailey[7]	Me46	Lab53	×		(BC49)	(BC50)			

[1] See p. 258. [2] See p. 258 and map 24. [3] See p. 249 and map 6.

[4] Eastern representative of *T. Wolfii* Vasey.

[5] *Sporobolus Richardsonis* (Trin.) Merrill.

[6] Eastern representative of *C. petricosa* Dewey and *C. Franklinii* Boott of the Canadian Rocky Mts. See p. 252 and map 16.

[7] *C. saxatilis*, var. *rhomalea* Fernald. *C. rhomalea* (Fern.) Mackenzie.

TABLE IV.—Continued.

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Juncus balticus, var. stenocarpus Buchenau & Fern.	Gasp48	Gasp49	×	(×)	(×)	(×)		(×)	(×)
balt., var. melanogenus Fern. & Wiegand	Lab51	Lab51	×	(×)	(×)	(×)		(×)	(×)
Vaseyi Engelm.	Me45	Lab50	×	×	Colo40	Ath59			
subtilis E. Meyer	Me46	Nfd49	×						
longistylis Torr.	Nfd48	Nfd49	×	×	Cal34	Alb54			
Luzula campestris, var. comosa (Meyer) Fern. & Wieg.[1]	Gasp49	Nfd50	×		Cal37	Alask55			
camp., var. acadiensis Fernald	Mass42	Nfd49	×						
Zigadenus elegans Pursh[2]	Vt44	Ming50	×	×	Ariz33	Alask67			(×)
Streptopus oreopolus Fernald	Gasp49	Gasp49	×						
Iris tenax Dougl.[3]	NB(48?)	Nfd(50?)	×		Oreg45	Wash47			
setosa, var. *canadensis* Foster[4]	Me44	Lab58	×		(Alask52)	(Alask67)			(×)
Sisyrinchium montanum Greene	Gasp49	Gasp49	×	×	Colo39	Alb56			
septentrionale Bicknell	Nfd48	Nfd48	×		Wash48	Alb51			
Habenaria unalascensis (Spreng.) Watson[5]	Antic50	Antic50	×	×	Cal33	BC55			
Epipactis decipiens (Hook.) Ames[6]	CB46	Gasp49	×	×	NMex33	BC51			
Listeria auriculata Wiegand	Me45	Ming50	×	×	BC51	BC51			
convallarioides (Sw.) Torr.	Vt44	Nfd51	×	×	Cal38	Alask56			×
Corallorrhiza striata Lindl.[7]	Gasp48	Gasp49	×	×	Cal36	Alb51			
Salix vestita Pursh[8]	Nfd48	Lab58	×		Oreg45	Alb52		×[9]	×
leiolepis Fernald[10]	Nfd48	Nfd48	×		(Oreg45)	(Alb52)			(×)
anglorum, var. kophophylla Schneider	Gasp49	Nfd50	×		(BC50)	(Alb52)	(×)		
angl., var. araioclada Schneider	Gasp49	Gasp49	×		BC50	Alb52	(×)		
angl., var. antiplasta Schneider	Gasp49	Gasp49	×		(BC50)	(Alb52)	(×)		
cordifolia, var. Macounii (Rydb.) Schneider	Nfd48	Lab62	×						
brachycarpa Nutt.[11]	Gasp49	Gasp49	×		Colo39	Alb59			
chlorolepis Fernald[12]	Gasp49	Gasp49	×		(Colo39)	(Alb59)			

[1] *L. comosa* Meyer.

[2] Including *Z. chloranthus* Richardson.

[3] Exact stations unkown. The plants, cited in Hooker's *Flora Boreali-Americana*, have been closely studied by Dr. S. F. Blake, who pronounces them unquestionable *I. tenax*, a species typical of dry open woods of western Oregon and adjacent California and Washington.

[4] *I. Hookeri* Penny.

[5] See p. 254 and map 19.

[6] See p. 254 and map 20.

[7] An extensive area extending from the upper Great Lakes to the Ottawa Valley.

[8] See p. 252 and map 15.

[9] A single station in eastern Lapland.

[10] Nearest related to *S. vestita*.

[11] See p. 249 and map 5.

[12] Nearest related to *S. brachycarpa*.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
myrtillifolia Anderss.	Gasp48	Lab52	×		Alb51	Mack65			
myrt., var. brachypoda Fern.	Nfd48	Nfd48	×		(Alb51)	(Mack65)			
glaucophylloides Fernald	NB46	Nfd49	×	(×)					
latiuscula Anderss[1]	Nfd(?)	Nfd(?)	×		(Oreg45)	(Alask60)			
obtusata Fernald[2]	Gasp49	Gasp49	×						(×)
calcicola Fernald & Wieg.[3]	Gasp49	Baf64	×		(BC59)	(Alask70)			
laurentiana Fernald[4]	Gasp49	Lab52	×		(Cal41)	(BC50)			
cryptodonta Fernald	Nfd49	Nfd49	×						
Bebbiana, var. capreifolia Fernald[5]	NS45	Gasp49	×	(×)	(×)	(×)			
Bebb., var. luxurians Fernald	Gasp48	Gasp49	×	(×)	(×)	(×)			
Bebb., var. projecta (Fern.) Schneider	Nfd49	Nfd49	×	(×)	(×)	(×)			
hebecarpa Fernald[6]	Gasp49	Gasp49	×		(Alask54)	(Alask64)			(×)
paraleuca Fernald	Gasp48	Gasp48	×						
pellita Anderss.[7]	NB45	Lab51	×	×	(Wash47)	(Alb51)			
Betula borealis Spach	Nfd48	Lab51	×						
papyrifera, var. elobata (Fernald) Sargent	Gasp49	Gasp49	×						
caerulea-grandis Blanchard	Vt43	PEI47	×						
microphylla Bung[8]	Nfd48	Lab54	×		Ariz36	Yuk65			×
Michauxii Spach	Nfd47	Lab52	×						
Comandra livida Richardson	NH44	Lab56	×	×	Idaho49	Yuk64			
Richardsiana Fernald	Vt44	Lab52	×	×	SDak45	Man50			
Rumex occidentalis Watson	Me45	Lab53	×	×	NMex33	Alask56			×
pallidus Bigelow[9]	Mass41	Nfd50	×	(×)	(Mex17)	(BC49)			
mexicanus Meisn.[10]	PEI46	Lab54	×	×	Mex17	BC49			
persicarioides L.[11]	Mass42	Gasp49	×	(×)	(Mex32)	(Sask53)			
maritimus, var. *fueginus* (Phil.) Dusén	RI41	Mag47	×	×	Mex32[12]	Sask53			
Polygonum Fowleri Robinson[13]	NS44	Lab52	×		Wash48	Alask57			

[1] Eastern representative of *S. Barclayi* Anderss. of the Pacific slope, with which Andersson at first united it. Exact locality in Newfoundland unknown.

[2] Seems to be related to *S. pyrolaefolia* Ledeb. of Siberia.

[3] Eastern representative of *S. Richardsonii* Hook. See p. 322 and map 56.

[4] See p. 256 and map 23.

[5] Typical *S. Bebbiana* (*S. rostrata* Richardson) or other varieties widely dispersed across Canada and in western America.

[6] Near relative of *S. fuscescens* Anderss. of Alaska and Siberia, with which it has been confused.

[7] Represented in western America by the very closely related *S. bella* Piper.

[8] *B. fontinalis* Sargent.

[9] Eastern relative of *R. mexicanus*.

[10] Indigenous about the Gulf of St. Lawrence, but in various parts of New England and eastern Canada recently introduced from the west via the Canadian Pacific and the Grand Trunk Railways.

[11] Local endemic representative of the widely dispersed *R. maritimus*.

[12] Isolated in the Fuegian region of South America. See p. 263.

[13] See p. 258 and map 25.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
allocarpum Blake[1]	Me44	NS45	×		(Wash48)	(Alask57)			
achoreum Blake	Vt44	Gasp49	×	×	Mont48	Sask(50?)			
Suaeda americana (Pers.) Fern.	Me43	Antic49	×						
Richii Fernald	Mass43	Nfd48	×						
Spergularia canadensis (Pers.) G. Don	Conn41	Lab52	×		Wash47	BC49			×
Arenaria dawsonensis Britton[2]	Gasp48	Lab52	×	×	SDak44	Yuk64			
marcescens Fernald[3]	Gasp49	Nfd50	×		(NMex36)	(Alb49)			
peploides, var. *maxima* Fern.	Nfd49	Nfd49	×		Alask52	Alask52			×
cylindrocarpa Fernald[4]	Nfd48	Lab59	×		Alb51	Alb51			
macrophylla Hook.[5]	Conn41	Lab58	×	×	Cal33	BC49			×
Stellaria florida Fischer	Gasp49	Gasp49	×		Alask71	Alask71			×
borealis, var. Bongardiana Fernald	Gasp48	Antic50	×		Cal38	Alask57			
Cerastium Beeringianum Chamisso & Schlecht	Gasp48	Lab52	×		Ariz35	Alask71			×
Fischerianum Seringe	Gasp49	Lab52	×		Alask52	Alask63			×
terrae-novae Fern. & Wieg.[6]	Nfd49	Nfd50	×		(Ariz35)	(Alb52)			
Claytonia caroliniana, var. sessilifolia Torr.[7]	Gasp49	Gasp49	×		Colo38	Alb52			
Ranunculus Purshii Richards	NS45	Gasp49	×	×	NMex35	Alask71		×	×
pygmaeus, var. petiolulatus Fernald[8]	Gasp49	Gasp49	×						
Allenii Robinson[9]	Gasp49	Lab59	×						
Macounii Britton	Gasp48	Nfd49	×	×	NMex33	Alask57			
Thalictrum confine Fernald[10]	Vt44	Ming50	×		(Colo40)	(Alb56)			
Anemone parviflora Michx.	NB48	Lab59	×	×	Colo39	Alask70			×
multifida, var. hudsoniana DC.[11]	Vt44	Nfd50	×	×	NMex36	Yuk64			

[1] Local derivative from *P. Fowleri*.

[2] *A. litorea* Fernald, the type from Gaspé.

[3] Eastern representative of *A. obtusiloba* (Rydb.) Fernald. See p. 250 and map 11.

[4] See p. 252 and map 13.

[5] No alpine stations south of the Shickshocks. In Asia known only in the Altai. See p. 261 and map 31.

[6] Eastern representative of the Rocky Mountain *C. Earlei* Rydb. See p. 250.

[7] *C. lanceolata* Pursh. In the Shickshock Mountains the sessile-leaved plant characteristic of western America passes insensibly to the typical *C. caroliniana* with the leaves petioled.

[8] Strongly resembling the Rocky Mountain *R. Grayi* Britton, but with the small petals and the achenes of the Arctic *R. pygmaeus*.

[9] *Ranunculus Allenii* may prove to be a large southern phase of the arctic *R. Sabinei* R. Br. I have seen no authentic material of the latter but Simmons's description and figures of it (Vasc. Pl. Ellesmerel, 112, t.3) suggest dwarf *R. Allenii*.

[10] In the *Illustrated Flora*, ed. 2, 120, Britton treats *T. confine* (1900) as identical with the northwestern *T. venulosum* Trelease (1886) or *T. campestre* Greene (1896). The author of *T. confine* was himself inclined so to do at one time and so labeled some collections. But the eastern plant has the stigmas 2.5–4.5 mm. long, the fruits (including the beak) 6–11 mm. long and the inflorescence and general habit rather lax. *T. venulosum*, a smaller plant with more slender inflorescence, has the stigmas only 1–2.8 mm. long and the mature fruit 4–6 mm. long. In view of these differences and their essentially distinct ranges, the two plants seem better treated, at least for the present, as distinct.

[11] Typical *A. multifida* also in the Andes.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
mult., var. Richardsiana Fernald.	Gasp48	Gasp49	×		Colo39	BC50			
Descurainia intermedia (Rydb.) Daniels[1]	NY44	Gasp49	×	×	Cal35	Alb51			
Hartwegiana (Wats.) Britton	Gasp48	Ming50	×	×	Cal36	BC52			
Cochlearia cyclocarpa Blake	Nfd48	Lab52	×						
triadctylites Banks	Magd47	Lab52	×						
Draba megasperma Fernald & Knowlton	NB48	Lab52	×						
pycnosperma Fern. & Knowlt.	Gasp49	Gasp49	×						
arabisans Michx.	Vt44	Lab51	×	×					
Arabis Collinsii Fernald[2]	Gasp48	Gasp48	×		SDak44	Alb50			
brachycarpa (T. & G.) Britton	Vt44	Gasp49	×	×	Colo39	Sask53			
Erysimum asperum (Nutt.) DC.	Nfd49	Ming50	×	×	Mex20	Sask54			
Drosera linearis Goldie	Me46	Nfd49	×	×	Alb51	Alb53			
rotundifolia, var. comosa Fernald.	NY44	Gasp49	×						
Saxifraga gaspensis Fernald	Gasp49	Gasp49	×						
Parnassia parviflora DC.	PEI47	Nfd51	×	×	NMex35	Alb51			
Amelanchier Fernaldii Wieg.	Magd47	Gasp49	×						
Fragaria multicipita Fern.[3]	Gasp49	Gasp49	×						
Potentilla pectinata Raf.[4]	NH43	Lab53	×		(NMex34)	(Alb53)			
fragiformis Willd.[5]	Gasp49	Baf64	×		Alask52	Alask72			×
pacifica Howell	NY41	Lab58	×		Cal34	Alask60			×
Rubus acaulis Michx.	Nfd47	Lab61	×	×	Wyo44	Alask68			×
Geum triflorum Pursh	Nfd(?)	Lab(?)	×	×	Mont47	Alb53			
Dryas Drummondii Richardson	Gasp48	Ming50	×	?	Mont47	Mack65			?
Sanguisorba canadensis, var. latifolia Hook.[6]	Antic50	Lab51	×		Oreg45	Alask64			
Rosa Williamsii Fernald	Gasp48	Gasp48	×						
Astragalus eucosmus Robinson	Me47	Lab59	×		Colo39	Yuk66			
aboriginum Richardson	Gasp49	Gasp49	×		Colo39	Mack69			
frigidus, var. americanus (Hook.) Wats.[7]	Gasp48	Gasp49	×		Colo39	Yuk65		(×)	(×)
Oxytropis viscida Nutt.	Gasp49	Gasp49	×		Colo39	BC58			
Hedysarum Mackenzii Richardson	Nfd48	Nfd48	×		Alb50	Yuk69			×
alpinum L.[8]	Nfd48	Lab52	×		Wash48	Alask67			×

[1] *Sisymbrium brachycarpon* Richardson, not *Descurainia brachycarpa* (Phil.) Prantl.

[2] Belongs to the complex of species characteristic of western America, now passing under the inclusive names, *A. arcuata* (Nutt.) Gray and *A. Holboellii* Hornem. See pp. 252 and 271.

[3] The only known station, on gravels of Rivière Ste. Anne des Monts, has apparently been destroyed by freshets and lumbering operations.

[4] Eastern representative of the western (and misnamed) *P. pennsylvanica* L.

[5] Including *P. nana* Willd. See Th. Wolf, Mon. Gatt. Pot. 511 (1908).

[6] *S. sitchensis* C. A. Meyer.

[7] Although often separated as *A. americanus* (Hook.) Jones, the American plant seems to be distinguished by no fundamental character from the Eurasian *A. frigidus* (L.) Gray.

[8] *H. occidentale* Piper.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
alpinum, var. americanum Michx.[1]	Vt48	Nfd49	×	×	Wyo42	Yuk69			
Callitriche anceps Fernald	Gasp49	Lab52	×						
Empetrum Eamesii Fern. & Wieg.[2]	CB47	Lab52	×		(S.Andes)	(S. Andes)			
atropurpureum Fern. & Wieg.[2]	NH44	Lab51	×		(S. Andes)	(S. Andes)			
Viola adunca, var. glabra Brainerd[3]	NB45	Lab59	×	×	Cal34	Alb51			
Elaeagnus argentea Pursh[4]	Que47	Gasp49	×	×	Colo38	Mack63			
Epilobium angustifolium, var. macrophyllum (Hausskn.) Fern.	Magd48	Magd48	×		Alask52	Alask58			
ang., var. platyphyllum (Daniels) Fern.	Gasp49	Gasp49	×	×	NMex33	Sask50			
nesophilum Fernald	Magd47	Nfd49	×						
wyomingense A. Nelson	Nfd48	Nfd51	×		Utah40	Yuk65			
Pylaieanum Fernald	Nfd47	Nfd48	×		(Utah40)	(Yuk65)			
palustre, var. longirameum Fern. & Wieg.	Lab51	Lab52	×						
pal., var. mandjuricum Hausskn.	Gasp48	Nfd51	×						×
glandulosum Hausskn	Gasp49	Lab52	×		Oreg42	Alask55			×
gland., var. cardiophyllum Fernald	Nfd48	Lab52	×		(Oreg42)	(Alask55)			(×)
gland., var. brionense Fern.	Magd48	Magd48	×		(Oreg42)	(Alask55)			(×)
boreale Hausskn.	Gasp49	Gasp49	×		Alask55	Alask55			
Drummondii Hausskn.	Gasp49	Lab59	×		NMex36	Mont(47?)			
Myriophyllum Farwellii Morong	NH43	Gasp49	×	×					
magdalenense Fernald	Magd48	Magd48	×						
Osmorhiza obtusa (C. & R.) Fern.[5]	NB47	Lab52	×		Ariz35	Alb53			
divaricata Nutt.[6]	NH44	Gasp49	×	×	Utah39	Alask59			
Conioselinum pumilum Rose[7]	Nfd49	Lab52	×						(×)
Coelopleurum lucidum (L.) Fernald[8]	NY41	Lab56	×		Alask52	Alask67			×
Cornus canadensis, var. intermedia Farr[9]	NH44	Lab58	×		Colo39	Alask67			
Pterospora andromedea Nutt.	NY43[10]	PEI47	×	×	Mex30	BC49			
Andromeda glaucophylla, var. iodandra Fernald	Nfd48	Nfd48	×						
Arctostaphylos rubra (Rehder & Wilson) Fernald	Antic49	Ming50	×		Alb50	Yuk65			×
Uva-ursi, var. adenotricha Fernald & Macbride	Ming50	Ming50	×		Mont46	BC52			

[1] *H. boreale* Nutt.

[2] Related to the Andean and subantarctic *E. rubrum* Vahl. See p. 263 and map 33.

[3] Typical *V. adunca* Sm. (*V. arenaria* Brainerd, not DC.) is more generally distributed across the continent.

[4] See p. 286.

[5] See p. 290.

[6] See p. 254 and map 21.

[7] Similar to and may be referable to *C. kamtschaticum* Rupr., the fruit having the univitatte sinuses of that species.

[8] Including *C. Gmelini* Ledeb. and *C. actaeifolium* (Michx.) C. & R.

[9] *C. unalaschkensis* Ledeb.

[10] A doubtful record from Penn.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Vaccinium cespitosum Michx.	Vt43	Lab54	×	×	Cal39	Alask70			
nubigenum Fernald[1]	Gasp49	Gasp49	×	(×)	(Oreg45)	(Alask60)			
ovalifolium Sm.[2]	Gasp49	Lab52	×	×	Oreg45	Alask60			
Primula farinosa, var. americana Torr.	Gasp49	Nfd51	×	×	(Colo38)	(Mont47)			
far., var. incana (M. E. Jones) Fernald	Ming50	Ming50	×		Colo38	Mont47			
far., var. macropoda Fern.	NS44	Lab53	×		Alb50	Mack62			
Androsace septentrionalis, var. robusta St. John	Ming50	Ming50	×		Mack68	Mack69			
Glaux maritima, var. *obtusifolia* Fernald	NJ40	Nfd51	×		Cal38	Alask60			×
Bartonia paniculata, var. iodandra (Robins.) Fern.	Nfd47	Nfd49	×						
Gentiana nesophila Holm[3]	Nfd48	Nfd51	×	(×)	(Mex23)	(Sask53)			(×)
propinqua Richardson	Nfd51	Lab52	×		BC49	Mack69			×
Halenia deflexa (J. E. Sm.) Griseb.	Me44	Lab53	×	×	SDak44	BC52			×
Collomia linearis Nutt.[4]	NB48	Gasp48	×		Cal34	Alb54			
Hackelia deflexa (Wahlenb.) Opiz, var. americana (Gray) Fern. & Johnst.[5]	Gasp48	Gasp49	×	×	Mont45	Alb50			×
Dracocephalum parviflorum Nutt.[6]	Gasp48	Gasp48	×	×	Ariz52	Yuk64			
Leucophysalis grandiflora (Hook.) Rydberg	Vt45	Gasp48	×	×	Sask53	Sask53			
Mimulus moschatus Dougl.[7]	NY43	Nfd49	×	×	Cal35	BC51			
Castilleja pallida, var. septentrionalis (Lindl.) Gray	NH44	Lab60	×	×	Colo39	Alask60			
Euphrasia Oakesii Wettst.	NH44	Lab52	×						
Williamsii, var. vestita Fern. & Wiegand	Nfd48	Nfd49	×						
purpurea Reeks	Sl44	Lab54	×						
purp., var. *Randii* (Robinson) Fern. & Wieg.	Me44	Lab52	×						
purp., var. *Farlowii* (Robins.) Fern. & Wieg.	Me44	Lab51	×						
disjuncta Fern. & Wieg.	Me47	Lab59	×		Alb51	Mack62			
Rhinanthus Kyrollae Chabert	NS44	Lab51	×		Wash48	Alb52			

[1] Endemic ally of *V. ovalifolium*.

[2] See p. 250 and map 10.

[3] Allied to several western species: *G. holopetala* Holm, *G. lanceolata* (Benth.) Griseb., *G. Macounii* Holm, etc.

[4] Occasionally introduced in western seed, but apparently native about the trap mountains at the head of the Baie des Chaleurs.

[5] See p. 291.

[6] Clearly indigenous at Bic, though occasionally introduced elsewhere in the East in western seed.

[7] Apparently indigenous in some areas (such as the Bay of Islands in western Newfoundland and woodland springs on the trap hills of the Magdalen Islands), though sporadic in occurrence, and at some eastern stations clearly of recent introduction.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Plantago eriopoda Torr.[1]	Que47	Antic50	×		Colo38	Yuk60			
Galium kamtschaticum Steller[2]	NY44	Nfd49	×		Wash48	Alask(?)			×
Brandegeei Gray[3]	Me46	Lab58	×	×	NMex35	Alb52			
Lonicera involucrata (Richardson) Banks[4]	NB48	Gasp49	×	×	Mex30	Alask56			
villosa (Michx.) R. & S.[5]	NH44	Lab52	×		(Cal38)	(BC49)		(×)	(×)
vill., var. Solonis (Eaton) Fernald	Conn42	Nfd49	×	×	(Cal38)	(BC49)		(×)	(×)
vill., var. calvescens (Fern. & Wieg.) Fern.	Conn42	Lab56	×	×	(Cal38)	(BC49)		(×)	(×)
Valeriana sylvatica Banks	Nfd48	Gasp49	×		Wyo41	BC59			
Solidago mensalis Fernald[6]	Gasp49	Gasp49	×		(Alb51)	(Alask68)			(×)
calcicola Fernald	Me47	Nfd49	×						
multiradiata Ait.	Nfd48	Lab61	×		Alb51	Alask68			×
Cutleri Fernald[6]	NY44	Me46	(×)		(Alb51)	(Alask68)			(×)
chlorolepis Fernald[7]	Gasp49	Gasp49	×		(NMex35)	(BC52)			
lepida DC.	Nfd49	Lab52	×		BC48	Alask60			
lep., var. molina Fernald	Me44	Gasp49	×		(BC48)	(Alask60)			
lep., var. fallax Fernald	Me44	Nfd49	×	×	Utah41	BC50			
lep., var. elongata (Nutt.) Fern.	Gasp48	Lab50	×		Cal35	Alb51			
graminifolia, var. septentrionalis Fern.	Gasp48	Nfd49	×						
Aster radula, var. strictus (Pursh) Gray	NH44	Lab60	×						
cordifolius, var. racemiflorus Fernald	PEI46	PEI46	×						
anticostensis Fernald[8]	Antic50	Antic50	×		(Cal41)	(BC50)			
foliaceus Lindl.	NH44	Lab53	×	×	NMex36	Alask60			
fol., var. frondeus Gray	Gasp48	Nfd50	×		Colo39	Alb52			
fol., var. arcuans Fernald	Gasp49	Gasp49	×		(Colo39)	(Alb52)			
fol., var. crenifolius Fern.	Gasp48	Gasp48	×		(Colo39)	(Alb52)			
fol., var. subpetiolatus Fern.	Gasp48	Antic50	×	(×)	(NMex36)	(Alask60)			
puniceus, var. oligocephalus Fern.[9]	NH44	Lab59	×		(Oreg45)	(Wash46)			
pun., var. perlongus Fern.	Gasp 49	Gasp49	×						

[1] The complex maritime group passing as *P. maritima* L., *P. decipiens* Barncoud, *P. borealis* Lange, etc., awaits detailed study. *P. maritima* of Europe is certainly not in eastern America. See p. 258.

[2] Piper (Fl. Wash. 526) reports *G. kamtschaticum* as occurring from Alaska to Washington. I have seen no western material.

[3] *G. brevipes* Fernald & Wiegand.

[4] See p. 286.

[5] *Xylosteum villosum* Michx. = *Lonicera velutina* DC.

[6] Apparently a derivative from *S. multiradiata*.

[7] Eastern representative of *S. decumbens* Greene. See p. 250.

[8] Perhaps not specifically distinct from *A. Douglasii* Lindl.

[9] The glabrous or glabrescent extreme of *A. Cusickii* Gray, found in the Blue Mts. of Washington and Oregon, is almost inseparable from the Shickshock plant which, however, seems to be an extreme development of the eastern *A. puniceus*, var. *oligocephalus*.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
laurentianus Fernald[1]	PEI46	Magd47	×		(Cal37)	(Man54)			(×)
laur., var. *contiguus* Fern.	NB48	NB48	×		(Cal37)	(Man54)			(×)
laur., var. *magdalenensis* Fern.	Magd47	Magd47	×		(Cal37)	(Man54)			(×)
subulatus, var. *obtusifolius* Fern.	NB48	NB48	×						
Erigeron hyssopifolius Michx.	Vt44	Nfd52	×	×	Man57	Mack63			
acris, var. oligocephalus Fern.	Gasp49	Lab59	×		Alb51	Mack67			
lonchophyllus Hook.[2]	Antic50	Antic50	×		Cal34	Alb52			×
Antennaria eucosma Fern. & Wieg.[3]	Nfd48	Antic50	×		(Idaho44)	(Alb52)			
cana (Fern. & Wieg.) Fern.[4]	Nfd48	Nfd51	×		(×)	(×)			
vexillifera Fernald[4]	Gasp49	Gasp49	×		(×)	(×)			
straminea Fernald[4]	Nfd48	Nfd51	×		(×)	(×)			
Peasei Fernald[4]	Gasp49	Gasp49	×		(×)	(×)			
subviscosa Fernald[4]	Gasp48	Gasp48	×		(×)	(×)			
albicans Fernald[4]	Nfd48	Nfd48	×		(×)	(×)			
neodioica, var. gaspensis Fernald.	Gasp48	Gasp49	×						
appendiculata Fernald	Gasp48	Gasp48	×						
glabrifolia Fernald	Lab50	Lab50	×						
spathulata Fernald	Nfd48	Nfd51	×						
spath., var. continentis Fern. & St. John	Lab50	Lab50	×						
Anaphalis margaritacea, var. subalpina Gray	SI44	Nfd50	×		Colo38	Alask60			
marg., var. occidentalis Greene	Mass42	Lab53	×	×	Cal36	Alask54			×
Bidens *hyperborea* Greene[5]	Mass43	Lab52	×						
cernua, var. *oligodonta* Fern. & St. John	Mass43	Magd47	×	×					
heterodoxa (Fern.) Fern. & St. John	PEI46	Magd47	×						
het., var. *orthodoxa* Fern. & St. John	Magd47	Magd48	×						
Tanacetum huronense, var. terraenovae Fern.[6]	Nfd48	Nfd51	×	(×)	(Cal41)	(Alask66)			(×)
Artemisia canadensis Michx.[7]	Vt44	Lab54	×	×	Ariz35	Sask52			×

[1] See p. 260 and map 30.

[2] See p. 254 and map 18.

[3] Eastern representative of *A. lanata* (Hook.) Greene.

[4] Related to the circumpolar *A. alpina* (L.) Gaertn. and to a large series of cordilleran American species.

[5] Including varieties.

[6] Newfoundland representative of an inland and Great Lake species. Closely related also to *T. bipinnatum* (L.) Schz.-Bip. of northwestern America and Siberia, and to *T. Douglasii* DC. of the coast from Vancouver Island to Humboldt Co., California.

[7] *Artemisia canadensis* and *A. borealis* Pallas are well marked extremes but possibly will prove to be varieties of one species. Until they can be more thoroughly studied, however, less confusion will result from keeping them apart than from hastily uniting them. Hall & Clements (Philog. Meth. in Taxon. 124) have misinterpreted *A. canadensis* Michx., saying "The original characterization is too brief to permit a determination of the exact form. But since the type locality is Hudson Bay, where typical [*A. campestris*] *borealis* grows, there is no reason to assume that it is fundamentally different from that subspecies. . . . Gray greatly extended Michaux's species to include the common small-headed form of the western United States now referred [*i. e.* by Hall & Clements] to subspecies [*A.*

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
frigida Willd.[1]	Gasp49	Gasp49	×		Ariz35	Yuk64			×
Petasites vitifolius Greene[2]	Gasp49	Gasp49	×	×	Alb51	Mack66			
Arnica pulchella Fernald[3]	Nfd48	Nfd48	×		(Alb51)	(BC60)			
Griscomi Fernald[4]	Gasp49	Gasp49	×		(×)	(×)			
chionopappa Fernald[5]	NB47	Gasp49	×		(SDak44)	(SDak44)			
gaspensis Fernald[4]	Gasp49	Gasp49	×		(×)	(×)			
mollis Hook	NH44	Gasp49	×		Colo38	Alb51			
mol., var. petiolaris Fern.	NH44	Gasp49	×		(Colo38)	(Alb51)			
Senecio resedifolius Less.[6]	Nfd48	Gasp49	×		Alask52	Yuk69			×
pauciflorus Pursh	Gasp49	Lab59	×		Cal38	Alask66			
indecorus Greene[7]	Que48	Gasp49	×	×	Cal40	BC52			
Robbinsii Oakes[8]	Vt43	Gasp49	×		(NMex35)	(Alb52)			
pauperculus Michx.[9]	NH44	Lab52	×	×	Colo39	BC52			
paup., var. firmifolius Greenman	Gasp48	Nfd51	×	(×)	(Colo39)	(BC52)			
Pseudo-Arnica Less.[10]	NB45	Lab55	×		BC50	Alask67			×
Ps.-Arn., var. *Rollandii* Victorin	Ming50	Ming50	×		(BC50)	(Alask67)			(×)
Cirsium muticum, var. monticola Fern.	Gasp48	Lab52	×						
minganense Victorin	Ming50	Ming50	×		(×)	(×)			

campestris] *pacifica*." To those who have studied Michaux's type, however, there are important reasons for not referring *A. canadensis* outright to *A. borealis*. The type was perfectly familiar to Asa Gray and it has been studied by the present writer. It is not at all the typical arctic *A. borealis*, which, at the southern limits of its range, in Newfoundland and Gaspé, occurs only in alpine habitats; but it is the common plant of river-gravels, sands and rock-talus at low altitudes from southern Labrador and Newfoundland to New England, the Great Lake region and westward, in the latter region passing as *A. pacifica* Nutt. Instead of coming, as Hall & Clements say, from "Hudson Bay," Michaux's *A. canadensis* came from "moving sands along lakes *toward* Hudson Bay" (in arena mobili secus lacus, ad sinum *Hudsonis*), which to those familiar with Mixhaux's routes means the sands by the lakes in the vast silicious area about the upper waters of the Saguenay and Rupert Rivers.

It is highly improbable that Hall & Clements will be followed by other systematists in merging these boreal rosette-herbs with the oriental and central European suffruticose *A. campestris* L., a species with much smaller and comparatively slender heads. A "philogenetic" treatment which, without more convincing evidence than has been presented, leads to this result is hypothetical in the extreme.

[1] *A. frigida* occurs on the sandy terraces along the north side of the Gaspé Peninsula with indigenous species. It is possibly introduced and where browsing animals are pastured it is often the only plant left to mature. It is in a region where western types are dominant in the indigenous flora and where recent introductions from the West by man are improbable.

[2] Including *P. trigonophyllus* Greene, Leaflets, i. 180 (1906). Both extremes and every conceivable intermediate occur on the subalpine meadows of the Shickshock Mts.

[3] Newfoundland representative of *A. tomentosa* J. M. Macoun of the mountains of Alberta and British Columbia.

[4] Allied to several cordilleran species, though not closely to any one of them.

[5] Eastern representative of *A. arnoglossa* Greene of the Black Hills.

[6] Including *S. Fernaldii* Greenm. See p. 260 and map 29.

[7] *S. discoideus* of recent Am. authors, not *S. discoideus* Hook., which is apparently a coarse extreme of *S. pauciflorus*. See Fernald, Rhodora, xxv. 116 (1924).

[8] Represented in the West by *S. pseudaureus* Rydberg.

[9] For discussion see Fernald, Rhodora, xxiii. 299 (1922). Var. *Balsamitae* (Muhl.) Fern. extends far to the south.

[10] See p. 260 and map 28.

TABLE IV.—Continued

	Southern Limit in Eastern America (east of Great Lakes)	Northern Limit in Eastern America (excluding Greenland)	Region about Gulf of St. Lawrence	Region about Great Lakes	Southern Limit in Western America	Northern Limit in Western America	Northern Limit in Greenland	Europe	Asia
Taraxacum lacerum Greene	Gasp49	Nfd51	×		Wyo41	BC60			
latilobum DC.	Nfd49	Nfd51	×						
Agoseris gaspensis Fernald[1]	Gasp49	Gasp49	×		(Cal41)	(Alb52)			
Prenanthes racemosa Michx.	NB45[2]	Lab51	×	×	Colo40	Alb54			
trifoliolata, var. nana (Bigel.) Fern.	NH44	Lab52	×						
Hieracium canadense, var. hirtirameum Fern.	Me45	Nfd49	×						

Having the great mass of facts now clearly before us we may return to the consideration of the western plants listed in Table IV. Various possible explanations of their isolation in the East suggest themselves:—wind-dispersal; water-dispersal *via* the Saskatchewan and St. Lawrence systems; transportation by animals; migration toward the close of the Pleistocene glaciation or soon thereafter over the broad intermediate region which is now inhospitable to these plants; or broad dispersal prior to the Wisconsin glaciation and the subsequent elimination of all but the isolated relic-colonies. Since these possibilities all deserve careful consideration they will be taken up separately and in the order above indicated.

POSSIBILITY OF DISPERSAL FROM THE WEST BY WINDS

A limited number of the species in Table IV are clearly not adapted for wind-dispersal: such plants as the pondweeds, *Potamogeton; Iris setosa* (shores of the North Pacific and of Bering Sea, its var. *canadensis* on the coast from southern Labrador to eastern Maine); *Arenaria macrophylla* (map 31); *Astragalus aboriginum* (Rocky Mts. south to Colorado; cliffs and talus of Mt. St. Pierre, Gaspé) and other western species of *Astragalus* and *Oxytropis; Elaeagnus argentea* (the Silverberry of the Northwest, occurring at scattered stations from the Isle of Orleans to Gaspé); *Osmorhiza divaricata* (map 21) and *O. obtusa* (Rocky Mountains, Newfoundland, Gaspé, etc.); *Arctostaphylos rubra* (Canadian Rocky Mountains, Keewatin, Anticosti and the Mingan Islands); *Vaccinium ovalifolium* (map 10), *Plantago eriopoda* (p. 258) and *Lonicera involucrata* (cordilleran region south to Mexico, region of Lake Superior and James Bay, Shickshock Mountains and adjacent area). Some of these, the pondweeds, *Elaeagnus*, *Arctostaphylos*, *Vaccinium* and *Lonicera*, have heavy berries or drupes; and the species of *Iris*, *Oxytropis* and *Astragalus* have hard and heavy seeds often as large as kernels of pop-corn. But, except for these dozen or so species, all the others have seeds light enough for wind-dispersal and many of them have their seeds modified apparently to that end: such plants as the ferns with minute spores; the willows with comose seeds; *Dryas Drummondii* (Canadian Rocky Mountains and adjacent Montana; Gaspé, Anticosti and the Mingan Islands) with long plumes; *Agoseris gaspensis* (map 12), *Erigeron lonchophyllus* (map 18) and *Senecio resedifolius* (map 29) with pappus of long and capillary bristles. These are all scattered by wind. It is, therefore, not unreasonable to imagine that such

[1] Eastern representative of *A. gracilens* (Gray) Kuntze. See p. 250 and map 12.

[2] A colony of a possibly distinct plant isolated in southeastern New York and adjacent northeastern New Jersey.

species might have made the migration in post-glacial times by the spores or seeds blowing upon strong westerly and northwesterly winds (with possibly many descents to the dry ground and as many reascents for new flights) until they found congenial habitats about the Gulf of St. Lawrence.

But there is very important evidence which indicates that this has not been the means by which the Shickshock Mountains and other regions bordering the Gulf of St. Lawrence have received their cordilleran flora. An examination of Table I will show that of the 94 arctic and arctic-alpine species of New England, 89 or nearly 95 *per cent* are found about the Gulf of St. Lawrence as well. In fact, many of the arctic species, like *Phleum alpinum*, *Luzula spicata*, *Polygonum viviparum* or *Epilobium Hornemanni*, which in New England are confined to altitudes mostly above 4000 feet (1220 m.), are about the Gulf of St. Lawrence as frequent at sea-level as in the alpine districts. Further examination of Table I will show that three-fourths of these arctic plants which occur on the mountains or coasts of New England are European as well. They, along with some plants of Table II and probably many of those of Table III, are the circumpolar species which in the Pleistocene were forced south by the continental glaciation which covered much of northern North America and of Europe. Their Pleistocene migration has been so often discussed that it needs no detailed elaboration here.

When, however, the data in Tables I–IV are summarized certain facts of significance in this connection appear. These are stated in Table V.

TABLE V. NORTHERN AND SOUTHERN LIMITS OF THE PLANTS ENUMERATED IN TABLES I–IV.

	Southern Limits in E. America		Northern Limits in E. America		Southern Limits of Species represented in W. Am.		Northern Limits of Species represented in W. Am.		Northern Limits of Species represented in Greenland	
	Extremes	Average	Extremes	Average	Extremes	Average	Extremes	Average	Extremes	Average
Table I.	36–46	43	44–85	65	19–66	44	52–72	66	61–85	73
Table II.	44–51	49	48–83	69	34–66	41	51–72	66	68–83	73
Table III.	41–51	47	46–64	51	19–64	44	41–72	59	61–68	64
Table IV.	41–51	47	45–64	51	15–71	40	44–71	57	—	—

It is at once apparent that the western types which occur about the Gulf of St. Lawrence (included in Table IV) do not reach the Arctic Circle in the East and only in very rare cases (only about 20) in the West. In eastern America their northern limits range from latitude 45° to 64°, with an average of 51°. This is in marked contrast to the plants of Table I, the Arctic species which reach New England. The northern limits in the East of the latter species range from 44° to 85°, with an average of 65°, or 14° farther north than the plants of Table IV. In western America, similarly, the average southern and northern limits of the plants of Table IV are 40° and 57° respectively as contrasted with those of Table I with southern and northern limits averaging 44° and 66°. The western plants which are localized in the East are, then, as a group clearly not so boreal as are the arctic and arctic-alpine species which extend south to New England and with which they closely mingle about the Gulf of St. Lawrence.

If we exclude from Table IV the plants, like *Isoetes macrospora*, *Juniperus communis*, var. *megistocarpa*, *Eleocharis nitida* or *Carex Deweyana*, var. *collectanea*, which are not isolated from the West or which are as nearly related to eastern as to western allies, we shall have left 225 plants of Table IV which are either isolated from western America or are eastern American representatives of species of cordilleran or Pacific America or of Asia. If these plants have arrived by wind-transportation from the West in recent times we should expect the greater proportion of them to occur on the mountains and other favorable habitats of the Northeast which lie nearest the western areas of the species; *i.e.* the largest number should be in the Adirondack area (with mountains averaging much higher than in Gaspé and Newfoundland), a smaller

number in the Green Mountain area, fewer still in the White Mountains and comparatively few in the region of northern and eastern Maine and adjacent New Brunswick (including Mt. Katahdin and other high mountains, the bleak coast from Penobscot Bay to the Bay of Fundy, and the St. John valley), while the more remote region about the Gulf of St. Lawrence should have fewest of all.

That the actual distribution in eastern America of the western types is, however, exactly the reverse of this hypothetical condition is clearly shown by the facts summarized in Table VI.

TABLE VI. NUMBER OF WESTERN (OR ASIATIC) TYPES IN TABLE IV OCCURRING IN DIFFERENT FAVORABLE REGIONS OF EASTERN AMERICA.

Long. 75°–73°30′ Eastern New York, including the Adirondack Mts., reaching 5344 ft. (1630 m.) altitude	Long. 73°15′–72° Including the Green Mts., reaching 4430 ft. (1350 m.) alt., headlands of Lake Champlain, etc.	Long. 72°–70° Including the White Mts. of Maine and New Hampshire, reaching 6300 ft. (1922 m.), and headlands of the St. Lawrence eastw. to Charlevoix and Kamouraska Cos., Quebec	Long. 70°–68° Including coast of E. Maine, highest mts. of Me., reaching 5270 ft. (1623 m.), St. John Valley of Me. and N.B., and the St. Lawrence eastw. to the Manicouagan and W. Matane Co., Quebec	Long. 68°–57° Region of Gulf of St. Lawrence, reaching in the Gaspé Peninsula an alt. of 4350 ft. (1327 m.), in Nfd. of 2700 ft. (823 m.)
11 species or 5%	28 species or 12%	41 species or 18%	67 species or 30%	225 species or 100%

If, therefore, the western plants have reached the East from the West by wind-dispersal in post-glacial time, it is certainly extraordinary that so few of them should have made successful landings on the Adirondack Mountains and the mountains (averaging twice as high as in Gaspé and Newfoundland) and the coast of New England, but should practically all have passed by these congenial habitats to start anew in a region to the east and northeast.

To some extent, of course, these plants in their eastern habitats are restricted by lithological differences: *Athyrium alpestre*, var. *americanum*, *Danthonia intermedia*, *Festuca scabrella*, *Epipactis decipiens*, *Epilobium Drummondii*, *Petasites vitifolius* and *Agoseris gaspensis* found chiefly on granite and schists; *Polystichum mohrioides*, var. *scopulinum*, *Pellaea densa*, *Salix brachycarpa*, *Arenaria marcescens*, *A. cylindrocarpa* and *Solidago chlorolepis* chiefly or exclusively on magnesian rocks; *Festuca supina*, *Poa Sandbergi*, *Carex misandroides*, *Salix vestita*, *Dryas Drummondii*, *Astragalus aboriginum*, *Oxytropis viscida*, *Hedysarum Mackenzii*, *Senecio resedifolius* and *S. indecorus* on calcareous rocks; and *Puccinellia macra*, *P. lucida*, *Hordeum boreale*, *Salix laurentiana*, *Rumex occidentalis*, *Plantago eriopoda* and *Aster laurentianus* on the seashores. But growing, often in the most intimate association, with these plants about the Gulf of St. Lawrence are the arctic species which extend from north of the Arctic Circle to the high mountains of New England or New York or to the coast of Maine or sometimes Massachusetts, Connecticut or even farther south: *Lycopodium Selago*, *Agrostis borealis*, *Hierochloe alpina*, *Carex scirpoidea*, *Juncus trifidus*, *Luzula confusa*, *Salix herbacea*, *Oxyria*, *Sibbaldia*, *Phyllodoce*, etc. on the granites and schists; *Scirpus cespitosus*, var. *callosus*, *Carex concolor*, *Salix Uva-ursi*, *Silene acaulis*, var. *exscapa*, *Rhododendron lapponicum*, etc. on the serpentines as well as the granites and schists; *Woodsia glabella*, *Thelypteris fragrans*, *Calamagrostis hyperborea*, *Braya humilis* and *Saxifraga oppositifolia* on the limestones and slates; and *Elymus arenarius*, var. *villosus*, *Carex norvegica*, *Montia lamprosperma*, *Stellaria humifusa*, *Lathyrus maritimus*, *Mertensia maritima* and *Plantago decipiens* on the sea-shores.

Obviously, since the arctic types which reach New England and New York are quite at home

among the cordilleran types about the Gulf of St. Lawrence, we should expect the latter plants, which are decidedly more southern in their broad ranges in western America, practically all to occur in New England if they have been brought to the East from the West by winds during the thousands of years since the receding of the glacial ice from southern New England. But, since these cordilleran and Pacific coast plants have for the most part so signally failed to take possession of the New England habitats which are well adapted to their requirements both of soil and of temperature, it is apparent that we must seek further for a satisfactory explanation of the occurrence of the great majority of them about the Gulf of St. Lawrence.

POSSIBILITY OF DISPERSAL FROM THE WEST BY WATER

The migration of western plants to the Gulf of St. Lawrence seemed perfectly simple of explanation when in 1869 G. F. Matthew wrote: "Three of the largest rivers in the Old World, and an equal number of those of the New, help to freshen the waters of this great oceanic stream [Arctic Drift]. The Spring floods of the great Siberian water-courses sweep down into it vast quantities of drift-wood and debris filled with the seeds of plants. Many of these are carried onward in the floe-ice toward the American coast, where they receive accessions from the McKenzie River, and, in the course of years work their way through the group of islands between North America and Greenland. The Saskatchewan River also contributes its quota of organic relics to the burden borne on the bosom of the Polar current from the Arctic regions of the three continents. The peculiarity of all these great water courses is, that their sources are in temperate latitudes, while their embrouchures are in Arctic or Sub-arctic regions, and thus the waste of vegetation which they bear downward toward the sea, when they are swollen by melting snows, is cast upon the ice about their mouths. The seeds of plants flourishing in the regions from which these rivers flow might thus very readily be transported in the course of time, upon floe-ice and driftwood, to the north-eastern parts of America.

"Accordingly we find little difficulty in tracing back the course of the Boreal and Arctic types north-westward across the Continent of America, toward Asia. . . . In the St. Lawrence Valley, chiefly in that part of it below the Great Lakes and around Lakes Huron and Superior, more than two-thirds of the list [Matthew's list] of Boreal species occur;—many of these being only known in the far western parts of the Valley about Lakes Superior and Huron, or on the mountain tops of New England and New York. The presence of these species in Acadia [as defined by Matthew including northern Maine and New Brunswick as 'Continental Acadia' and Nova Scotia and the 'twin islands of Prince Edward and Cape Breton' as 'Insular Acadia'] is easily accounted for when it is considered that there is a continuous water communication from the great lakes of the interior to the northern confines of Acadia. But it is more remarkable, if we fail to give due weight to the transporting powers of the Polar Current, that all the high Northern forms, with half a dozen exceptions, should be already known as indigenous to the North West Territory, between Red River, the Arctic Sea, and the Rocky Mountains." [1]

It is of course obvious that Matthew was not at that time recognizing the profound effect of Pleistocene glaciation, although his subsequent work has taken full cognizance of it. But the extract above quoted is here introduced because, by appealing to water-dispersal, both by ocean currents and rivers, it is very typical of many attempts to explain discontinuous distribution. In recent years, however, Praeger, Guppy and others have clearly shown that only a very few seeds, and those the large fruits of littoral plants, have sufficient buoyancy to keep afloat in ocean-drift for more than a very few days, and not one of the plants of Table IV, unless

[1] G. F. Matthew: On the Occurrence of Arctic and Western Plants in Continental Acadia—Can. Nat. n.s. iv. 160, 161 (1869).

it be the very few with berries or drupes, has fruit which would withstand such an arduous and prolonged journey as is defined above; furthermore, as Guppy states, "dispersal by currents is mainly restricted to warm latitudes. Whilst in the tropics seed-drift is abundant on the beaches, in the cooler regions of the globe it is usually very scanty." [1] Even if one could possibly conceive the small and thin-walled seeds or spores of *Woodsia scopulina, Carex concinna, Salix brachycarpa, Dryas Drummondii* or *Valeriana sylvatica* washed down tributaries of the Saskatchewan or the Mackenzie into the Arctic, ultimately to land on the mountains or in the inland valleys of Gaspé, it would be more difficult to conceive a similar route of migration for the majority of the plants of Table IV.—*Polystichum mohrioides*, var. *scopulinum, Poa Sandbergi, Cerastium Fischerianum, Epilobium glandulosum, Senecio indecorus, Agoseris gaspensis*, etc.—for the simple reason that the ranges of these species or of their western representatives are very remote from the headwaters of the Mackenzie and the Saskatchewan. And, in case of the littoral plants, the only group in which Praeger and Guppy find effective dispersal by floating in the ocean, it should be noted that the majority of these occur too far south to get into the polar current and even if by some remote chance they should reach it, it is most difficult to imagine the seeds of such plants as *Puccinella macra* (or *nutkaensis*), *Poa eminens, Hordeum boreale, Salix laurentiana* (or *Hookeriana*), *Polygonum Fowleri* and *Senecio Pseudo-Arnica* remaining both buoyant and viable after the many months or presumably years necessary for such a voyage.

As for the transport by way of streams flowing eastward from the cordilleran region to commingle with waters entering the Great Lakes, it should be noted that three-fourths of the western plants (Table IV) are not found about the Great Lakes, although the region of Lake Superior (and sometimes of Lake Huron) has proved hospitable to some species especially of the Pacific slope, and this region harbors a surprisingly large proportion (33%) of the arctic-alpine species of Table I. Furthermore a brief glance at a map is sufficient to show that only two considerable east-flowing river-systems rise in the cordilleran region in the latitudes chiefly occupied by the plants of Table IV. These are the Saskatchewan, flowing into Lake Winnipeg which itself discharges into Hudson Bay; and the Missouri, which unites with the Mississippi fully 550 miles (885 km.) south of the head of Lake Superior. The explanation of the occurrence of this extensive western flora about the Gulf of St. Lawrence as due to water-dispersal is, then, wholly unsatisfactory.

POSSIBILITY OF DISPERSAL FROM THE WEST BY ANIMALS

This method of transportation, whether by mammals or birds, may be of consequence very locally, but it would be forcing a highly unreasonable argument to maintain that the mammals of the Pacific slope have brought to the region of the Gulf of St. Lawrence a large proportion of the species of the region or that our northeastern mammals have been performing a reciprocal function for the West. In the first place it would be necessary to prove the improbable: that the seashore, woodland and mountain mammals of the two sides of the continent make any such migrations; and if any such instance could be found it would be quite unreasonable to expect the seeds of hundreds of species of the most diverse habitats to cling to their fur without being brushed or cleaned off somewhere in the broad intermediate regions whence these plants are quite unknown.

Only three of the cordilleran or Asiatic plants which in the East have their greatest development on the Gaspé Peninsula have armed or bristly fruit which readily clings to the fur of passing animals, and in these cases maps of the distribution of the species indicate that their tendency at present is to spread *from* the Gaspé region rather than toward it. Thus, *Osmorhiza obtusa*, isolated

[1] Guppy: Plants, Seeds and Currents, 77 (1917).

from the Rocky Mountains, is everywhere abundant in woodlands and thickets from sea-level to the subalpine regions of Gaspé, but west of the Gaspé Peninsula it is excessively rare: known from only two stations, one at Bic in Rimouski County, Quebec (which, on account of its situation, topography and flora, is included in Table IV under "Gasp48"), the other in northwestern New Brunswick. *O. divaricata* (map 21), quite as abundant, especially at low altitudes, in Gaspé, has spread somewhat farther, but always locally, to north-central Maine and northern New Hampshire; while the third species with burr-fruits, *Hackelia deflexa*, var. *americana*, isolated in the East, is characteristic of calcareous sea-cliffs and mountains in Gaspé and Bonaventure Counties, Quebec, and in adjacent northeastern New Brunswick; but outside that region it has been found in the East only at a single roadside station in northern Vermont, where its discoverer inclined to the belief that it has been recently introduced by man "from its home in the far West, rather than from the much nearer 'Eastern Quebec' "; and stated that it "is admirably adapted by its prickly-barbed nutlets to easy and wide distribution by railroads and other carriers. And yet my brief study of this species and its history indicates that, despite these devices for migration, the plant has failed hitherto to extend materially its long recorded range." [1]

The only other plants besides those with barbed fruit which ordinarily depend upon animals for their dissemination are those with berries and drupes or with nuts or other reproductive bodies too heavy for transport overland by winds. If we concede that the fruits of grasses and sedges might readily be dispersed by winds and those of the truly maritime plants by floating along shore, we shall find that among the Arctic-alpine plants of Table I there are 7 species with fruit ill-prepared for wind-dispersal or swashing in salt water and largely dependent upon animals for their transportation. All of these Arctic species, *Polygonum viviparum* (with bulblets), *Rubus Chamaemorus*, *Empetrum nigrum*, *Arctostaphylos alpina*, *Vaccinium pennsylvanicum*, var. *angustifolium* and *V. Vitis-Idaea*, var. *minus*, occur on the mountains of New England as well as about the Gulf of St. Lawrence. But when the heavy-fruited species of Table IV, the species centering about the Gulf of St. Lawrence, are counted, we find 28 of them which are western American or with western American relationships. Of these 28 species, 1, *Thalictrum confine*, a riparian species with corky and readily floating fruits, extends locally west to the New York shore of Lake Champlain; 6 more are found in eastern America as far west as Vermont: *Juniperus horizontalis*, *Comandra livida*, *Polygonum achoreum*, *Arenaria macrophylla*, *Vaccinium caespitosum* and *Leucophysalis grandiflora;* 3 more, *Potentilla pectinata*, *Elaeagnus argentea* and *Cornus canadensis*, var. *intermedia*, to the longitude of New Hampshire or of the city of Quebec; and 2 more, *Iris setosa*, var. *canadensis* (maritime but always in fresh and well drained habitats, avoiding truly saline situations) and *Astragalus eucosmus* to eastern Maine; while the remaining 16, the majority, *Iris tenax*, *Sisyrinchium montanum* and *S. septentrionale*, *Arenaria marcescens*, *Claytonia caroliniana*, var. *sessilifolia*, *Potentilla fragiformis*, *Rubus acaulis*, *Sanguisorba canadensis*, var. *latifolia*, *Astragalus aboriginum* and *A. frigidus*, var. *americanus*, *Oxytropis viscida*, *Arctostaphylos rubra* and *A. Uva-Ursi*, var. *adenotricha*, *Vaccinium nubigenum* and *V. ovalifolium* and *Lonicera involucrata*, are unknown in eastern America from west of the Gulf of St. Lawrence.

The majority (70%) of the western species which are found about the Gulf of St. Lawrence are quite unknown in New England, but, as already seen, of those which do reach the New England area the greater proportion are confined to the St. John Valley or to adjacent regions of northern Maine and they are there of decidedly rare and local occurrence as contrasted with their frequency about the Gulf of St. Lawrence; and it becomes perfectly clear that if animals are transporting these species they are bringing them *from* the region about the Gulf of St. Lawrence to the area immediately to the west rather than to the Gulf of St. Lawrence area from New England.

[1] J. R. Churchill, Rhodora, xviii. 139 (1916).

Exactly similar reasoning and the necessity of proving extensive migrations *across* the continent of seed-carrying birds renders the explanation of these widely disrupted ranges as due to dispersal by birds hardly tenable.

POSSIBILITY OF MIGRATION DIRECTLY OVERLAND

It is wholly conceivable that the isolation about the Gulf of St. Lawrence and in the cordilleran region of many plants is due to a gradual migration during the late stages of the Pleistocene along the cold fronts of the continental ice-sheets, the plants now restricted to cold and alpine or bleak habitats about the Gulf of St. Lawrence and in the West having found, upon the disappearance of the ice, congenial habitats in the Northeast and in the Northwest and occasionally about the headlands of Lakes Huron and Superior; the hot and dry summers of the lower or flatter areas between these three isolated regions soon proving wholly forbidding to these species, with the inevitable result that they have quite vanished from the broad intermediate regions. Such an explanation would be at once simple and reasonable and it is entirely possible that some interchange of this sort actually took place. Here again, however, as in the hypothetical cases already discussed, it would seem quite amazing that, with glacial conditions extending south across New York and New England the great majority of the plants of Table IV should so consistently have failed to find refuges on the bleak and high alpine summits and in the cold chimneys and ravines of the Adirondacks, the Green and the White Mountains or on Mt. Katahdin, which have altitudes from 1310–1920 m. (4300–6300 ft.) and which have retained a large proportion of the high-Arctic species which invaded New England from the North; but should have passed this intermediate alpine region to take possession of the comparatively low mountains and shores farther to the east.

In this connection it is well to consider another feature of the flora of New England, Nova Scotia and the region bordering the Gulf of St. Lawrence. Centering on the latter highly segregated region, consisting of isolated peninsulas, islands, coastal cliffs and sands, with an aggregate area of only a few thousand square miles we know 81 endemic species,[1] *i. e.* species which are restricted to the regions about the Gulf or which, abounding there, have extended their ranges only a few hundred miles to the north, west or south. These are indubitable species with deep-seated characters of the reproductive organs and in addition to these 81 endemic species the Gulf region has nearly as many (61) well differentiated geographic varieties, differing in minor or less fundamental characters. Some of the endemic species, like *Salix obtusata*, *Betula Michauxii* (so unique as sometimes to be separated as a genus), *Suaeda americana*, *Cochlearia cyclocarpa*, *Draba megasperma*, *D. pycnosperma*, *Rosa Williamsii*, *Callitriche anceps*, *Empetrum Eamesii*, *Myriophyllum magdalenense*, *Conioselinum pumilum*, *Antennaria glabrifolia* and *A. spathulata* are not closely related to other North American types; but many of the endemic species, such as *Puccinellia macra* and *laurentiana*, *Carex misandroides*, *Salix chlorolepis* and *laurentiana*, *Arenaria marcescens*, *Cerastium terrae-novae*, *Vaccinium nubigenum*, *Gentiana nesophila*, *Solidago chlorolepis*, *Aster anticostensis* and *laurentianus*, *Antennaria eucosma* and *albicans*, *Arnica pulchella* and *Agoseris gaspensis*, although wholly segregated by profound differences in the flowers or fruits, are closely related to species of the cordilleran region or the Pacific slope. The varieties, on the other hand, such plants as *Carex Deweyana*, var. *collectanea*, *Carex flava*, var. *gaspensis*, *Juncus balticus*, var. *stenocarpus*, *Salix myrtillifolia*, var. *brachypoda*, *Betula papyrifera*, var. *elobata*, *Aster cordifolius*, var. *racemiflorus* or *Tanacetum huronense*, var. *terrae-novae* are in no case segregates from geographically remote specific types, but are all geographically

[1] The number is really larger but, until they are published, several species are withheld from the list.

isolated representatives of species occurring on the adjacent continental region, or, as in the case of *Aster laurentianus* and its localized varieties, on closely adjacent, though segregated areas.

If, now, we compare with the flora of the Gulf of St. Lawrence region, with its 81 endemic species and 61 endemic geographic varieties, the floras of the White Mountains of New Hampshire and of peninsular Nova Scotia we shall find some very striking differences. The White Mountains are famous as reaching the highest altitudes of eastern America north of North Carolina, on their upper slopes and summits and in their alpine ravines presenting such bleak conditions that there we find not only 55 vascular plants of Greenland[1] and Lapland but various arctic animals as well. This rather extensive flora is commonly considered as a relic left on the White Mountains, as at other favorable stations in northern New England and eastern Canada, during the retreat northward of the ice-front at the close of Pleistocene glaciation, although Scharff, admitting that "Their relationship is almost altogether with Lapland and Greenland," maintains that, "It was during the Pliocene Period, I think, or earlier, and, at any rate, long before the commencement of the Glacial Epoch, that the animals and plants from Labrador thus found their way southward to the White Mountains."[2] Leaving, for the present, Scharff's interpretation, the important point in regard to the make-up of the vascular flora of the White Mountains is, that, although closely related to the flora of remote Greenland and Lapland and surrounded by a region of temperate forest, it contains only 3 endemic species and 2 endemic varieties. Like the endemic varieties found about the Gulf of St. Lawrence, the two in the White Mountain area are derivatives from wider-ranging species of eastern America, one, *Houstonia caerulea*, var. *Faxonorum*, being an alpine derivative of the common lowland Bluet or Innocence; the other, *Paronychia argyrocoma*, var. *albi-montana*, being the New England representative of a species of the Alleghenies. The 3 endemic species are *Geum Peckii*, *Potentilla Robbinsiana* and *Euphrasia Williamsii*, all members of notoriously plastic genera; the *Geum* nearly related on the one hand to the Alleghanian *G. radiatum* Michx., with which Gray united it as a variety, on the other apparently more closely approaching *G. calthifolium* Menzies of the North Pacific region; the *Potentilla* related to *P. frigida* Vill. of Europe, with which it has long been confused; the *Euphrasia* belonging in a close group of species which is scattered northeastward to Newfoundland and Labrador (*E. Williamsii*, var. *vestita*, *E. Oakesii*) while its other near relative is the Scandinavian *E. curta* Fries.

The flora of peninsular Nova Scotia has migrated into that region since the Pleistocene glaciation: "whereas the distinctive flora of the highly acid but cool Atlantic slope of Nova Scotia has been derived very largely from the now submerged continental shelf and has its affinities far to the South, the distinctive flora of the warmer, inland and less acid or even calcareous regions of the province . . . has come from the north, northwest and west by way of New Brunswick."[3]

[1] Scharff (*Distribution and Origin of Life in America*, 36), describing his visit to the Presidential Range, says: "Here and there may be gathered specimens of Rhododendron lapponicum and Salix phylicifolia, growing among Arenaria groenlandica, Phleum alpinum, Diapensia lapponica, Campanula rotundifolia, Gentiana nivalis and hosts of others, few of which can be studied elsewhere nearer than Labrador." The latter statement certainly applies to *Gentiana nivalis*, for, except for Scharff's assertion, there has never been any suggestion that in eastern America it occurs south of Labrador and the very close study of the White Mountains by scores of our most competent botanists has failed to reveal any member of the *Gentianaceae* in the alpine area. As to the other arctic plants of the White Mountains, Scharff was apparently unaware that practically all of them occur on several areas between the White Mountains and Labrador, that a lowland variant of *Arenaria groenlandica* is locally abundant in southern New England, thence southward to Georgia, and that *Campanula rotundifolia* is a common meadow and river-bank plant in many parts of New England. Although the arctic species found on the White Mountains also occur on the Shickshocks and on Mt. Katahdin, most of the Greenland types which occur in New Hampshire are isolated by a distance of 260 km. (160 miles) from the next area (Mt. Katahdin) to the northeast.

[2] Scharff, *Distribution and Origin of Life in America*, 42 (1912).

[3] Fernald, Rhodora, xxiii. 171 (1921).

The southern flora which characterizes the bleak Atlantic slope of Nova Scotia was derived from the southern Coastal Plain and its species are nearly all typical of the Coastal Plain region from New Jersey to Florida and Mississippi, there occurring in a climate obviously much warmer than that of the coast from Digby and Yarmouth Counties to Guysborough, Nova Scotia. Yet in this isolated Nova Scotian flora of far-southern origin we find but 1 endemic species, *Agalinis neoscotica* (Greene) Fernald, an annual of weed-like habit, growing in roadside-ditches and other open spots, and belonging in a group in which sharp specific lines are altogether too fickle. In fact, the monographer of the genus *Agalinis*, Pennell, has treated the Nova Scotian plant merely as a variety[1] of the more southern *A. purpercula* (Gray) Britton. Besides *Agalinis neoscotica* there are absolutely no other endemic species[2] in the Nova Scotian flora of remote southern origin. The greatest departures from the southern types are divergencies in pubescence, size, texture or habit, but not in fundamental reproductive characters. Of these minor geographic varieties 11 have been recognized as endemic derivatives from the southern Coastal Plain.

It is thus apparent that there is a profound difference in the number and proportion of endemic species and varieties in the flora of the region bordering the Gulf of St. Lawrence and in the alpine flora of the White Mountains and the isolated southern flora of Atlantic Nova Scotia. If we reason that the more thoroughly differentiated plants, the unquestioned species, are older than the partially segregated plants or geographic varieties (which are sometimes spoken of as incipient species), it would seem that the lands about the Gulf of St. Lawrence with their 81 endemic species have many more ancient plants than the White Mountains (with 3 endemic species) and Atlantic Nova Scotia (with 1 endemic species, the complete segregation of which has been doubted). That the White Mountains and Atlantic peninsular Nova Scotia were heavily scoured by the Pleistocene glaciers and that these regions have received most if not all their plants in post-glacial time no one who is familiar with their polished and furrowed rock-surfaces and boulder-strewn slopes can seriously doubt. To be sure Scharff, as already noted, maintains that the alpine flora (and fauna) of the White Mountains was there long before the Pleistocene, but the observations of the late C. H. Hitchcock and others at the summit of Mt. Washington should be sufficient to indicate that Scharff's position is untenable. In 1875 Professor Hitchcock found practically at the very summit of Mt. Washington boulders "corresponding in mineral structure with the ledges in Randolph and Jefferson, twelve or fifteen miles away. . . . The highest point, at which these stones of foreign origin were obtainable, may be twenty or twenty-five feet below the very pinnacle of the mountain. Hence it is fair to conclude that every part has been covered by the glacial ice."[3] Hitchcock's observations are accepted as valid by Goldthwaite, who spent six weeks in intensive study of the Presidential Range, Goldthwaite stating that the range "became completely buried by the ice sheet from Canada."[4]

This occurrence of a large number of ancient and endemic species on the areas about the Gulf of St. Lawrence which, as will be shown, were not denuded by the Pleistocene glaciers, while the heavily scoured Atlantic slope of peninsular Nova Scotia with a flora derived from far to the south has essentially no endemic species, is a point of great significance in estimating the rate of evolution of true species. If we accept the time since the receding of Wisconsin ice

[1] *A. paupercula*, var. *neoscotica* (Greene) Pennell & St. John in St. John, Proc. Bost. Soc. Nat. Hist. xxxvi. no. 1: 93 (1921).

[2] In 1922 *Lophiola septentrionalis* Fernald was distinguished as a Nova Scotian endemic, but studies of specimens from a second colony of the plant show that it is inseparable from *L. americana* (Pursh) Wood of the New Jersey Pine Barrens. See Rhodora, xxiv. 167 (1922).

[3] C. H. Hitchcock, *Existence of Glacial Action upon the Summit of Mt. Washington, N. H.*, Proc. Am. Assoc. Adv. Sci. xxiv. pt. 2: 95 (1876).

[4] J. W. Goldthwaite, *Glacial Cirques near Mount Washington*, Am. Journ. Sci. ser. 4, xxxv. 4 (1913).

from southern Nova Scotia as 25,000 years (a fair average of greatly varying estimates), it will at once be apparent that, although the vastly more ancient flora of Gaspé and the Long Range contains abundant endemic species, the best that Nature has been able to do in 25,000 years with species of Alabama, Florida and the Carolinas in the bleak climate of Atlantic Nova Scotia is to lengthen the trichomes or slightly to modify the foliage.[1]

We may now return to the original proposition, that, if the cordilleran and other western plants which occur about the Gulf of St. Lawrence migrated to the East from the West at the close of the Pleistocene glaciation, we should expect them to have occupied the alpine and subalpine areas of the Green Mountains, White Mountains and Mt. Katahdin which had been under the continental ice-sheet and which, upon the melting of this final sheet of ice were virgin territory ready to receive any plants adapted to alpine and subalpine conditions. That the western plants are largely absent from the New England mountains has been sufficiently emphasized. We have also sufficiently stressed the fact that regions like the White Mountains and Atlantic Nova Scotia, both occupied by plants since the Pleistocene glaciation, have few ancient or endemic species, while the region of the Gulf of St. Lawrence has a large number (81), chiefly of cordilleran or Pacific American affinity. This situation, as already noted, suggests that the flora which is segregated between western America and the region of the Gulf of St. Lawrence is much more ancient than the isolated floras which occupy the alpine region of the White Mountains and the sandy, rocky and peaty Atlantic slope of Nova Scotia.

GLACIATION ABOUT THE GULF OF ST. LAWRENCE

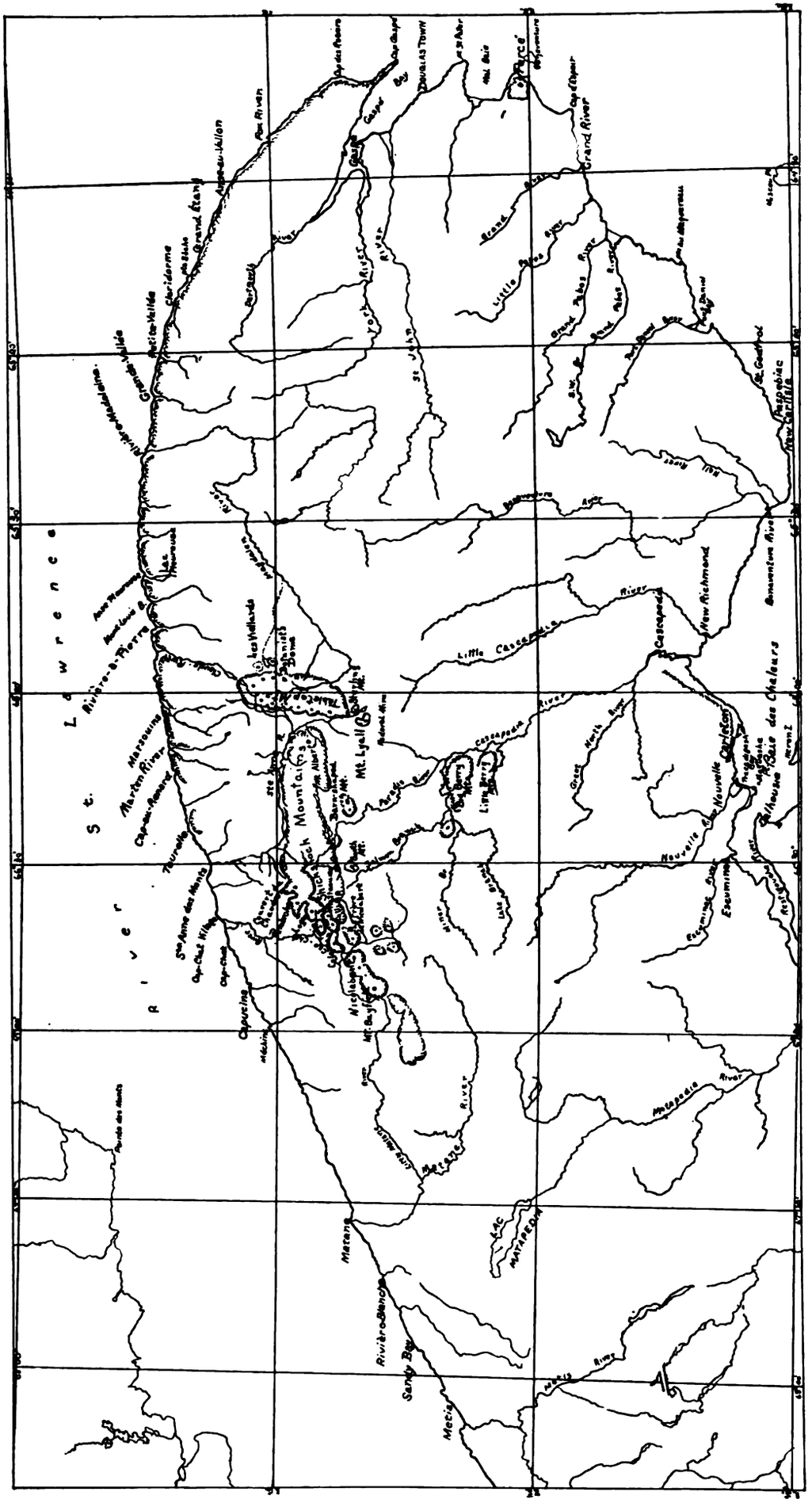
In the region from New England westward across the Plains we are so familiar with the nearly universal signs of extensive glacial action that we have come to think of the entire region as deeply covered by a nearly if not quite continuous sheet of ice pushing south from the Labrador Peninsula and overlapping in the Great Lake region an area which had long before been invaded by a similar sheet pushing south from Keewatin. So familiar is this concept that we have a tendency to extend it to cover the region to the east of New England and south of Labrador—the region of southeastern Canada and Newfoundland. The earlier students of the geology of the region about the Gulf of St. Lawrence, intent upon determining the identity and age of the rock-formations, made little mention of glacial phenomena, but during the last half-century considerable data have accumulated which give us a general idea of the conditions in southeastern Canada. The leading facts may conveniently be discussed under separate headings for the different areas.

Gaspé Peninsula (map 36)

In 1863 after a season of geological exploration on the Gaspé Peninsula, Dr. Robert Bell wrote:

"The superficial accumulations of this district differ in their general character from those of the country to the west. One of the most remarkable points of difference is the absence of foreign boulders in Gaspé. On arriving in Gaspé Bay last spring, my attention was at once arrested by the contrast presented to many other parts of the country by the general scarcity of boulders of any kind in the fields, notwithstanding the hilly nature of the ground. On examination it was found that the loose masses were chiefly confined to the summits and more abrupt slopes of the hills, and farther, that they always belonged to rocks which existed *in situ* close by. During the whole summer, which was spent mostly in the interior of the country of Gaspé, my attention was

[1] For further elaboration of this point see Fernald, *Isolation and Endemism in Northeastern America and their Relation to the Age-and-Area Hypothesis*, Am. Jour. Bot. xi. 564 (1924).


St. Lawrence River
Chic-Chocs Mountains
Mt. Logan
Mt. Albert
Mt. Lyall
Mt. Jacques Cartier
Mt. Richardson
Mt. Baillairge
Mt. Hyndman
Mt. Fortin
Mt. Ste Anne
Mt. Ste Marie
Mt. Ste Thérèse
Mt. Ste Famille
Mt. Ste Hélène
Mt. Ste Victoire
Mt. Ste Agnès
Mt. Ste Cécile
Mt. Ste Blanche
Mt. Ste Rose
Mt. Ste Claire
Mt. Ste Madeleine
Mt. Ste Geneviève
Mt. Ste Marguerite
Mt. Ste Catherine
Mt. Ste Barbe
Mt. Ste Julie

directed to the inquiry; but I failed to discover a single stone which had not been derived from the rocks of the country, until I visited Cape Gaspé and Point Peter, where boulders of Laurentian gneiss were found in abundance on the sea beach. While the erratic masses of the interior are probably due to ancient glacial action, the presence of the Laurentian boulders on the beach, on the northern sides of Cape Gaspé and Point Peter, is no doubt owing to recent icebergs. The proof of this lies in the fact of their occurrence only on the beach, and that at points projecting into the open sea frequented by drifting ice, while they appear to be altogether absent from the shores of the bay between these points. Gaspé Bay remains covered with fixed ice till late in the spring, and thus icebergs from the north are prevented from entering it. This want of far-transported boulders over such a large area, is a fact of great importance; for when we find loose fragments of useful minerals in this region we may be sure their source is not far off." [1]

Thirty years later the study of glacial geology of southeastern Canada was given new impetus, or almost initial impetus, through the work of Dr. Robert Chalmers in northern and eastern New Brunswick, and from 1890 to 1893 Chalmers continued his detailed studies of the surface geology, his fieldwork covering New Brunswick, northwestern Nova Scotia, Prince Edward Island and a portion of the Gaspé Peninsula. Briefly summarized, the glacial history of the Gaspé Peninsula as worked out by Chalmers was as follows. "The ice which covered the Gaspé Peninsula, and, indeed, all that part of the province of Quebec lying to the east of the Chaudière River and south of the St. Lawrence estuary, in the Pleistocene period, seems to have been local, although doubtless connected with the larger centre or centres of ice to the west. On the north side of the axis of the Notre Dame Range, it flowed into the St. Lawrence estuary. . . . The estuary must have been open during a part, if not the whole of the year, perhaps, similarly to Baffin's Bay and Davis Strait now, . . .

"The striae on this slope trend from N. 64° E. at Montmagny to due N. to N. W. at Trois Pistoles, Bic, etc., and in other places to N. 50° W., indicating a wide range in the movements, due chiefly to the inequalities of the surface and to the fact that the glaciers followed the local valleys. . . .

"In the eastern part of the Gaspé peninsula, the ice flowed eastwardly, following the courses of the river-valleys there also. . . . The facts respecting the striae in Gaspé Basin . . . show that a local glacier occupied its western end, drawing its supplies from the valleys of the York and Dartmouth rivers. . . . On the narrower peninsula terminating in Cape Gaspé, no ice-action is apparent. . . . . Following the coast of the Gaspé peninsula southward and westward, . . . the ice was still local. . . . The western end of the Baie des Chaleurs depression and the valleys of the Cascapedia, Nouvelle, Metapedia, Restigouche, etc., tributary to it, were occupied by a glacier in the early part of the Pleistocene. The terminus of this glacier was . . . nearly in a line across from the mouth of the Bonaventure River, Quebec, to Belledune Point, New Brunswick. East of this line on both sides of the Baie des Chaleurs, the striae indicate ice-movements more directly into the depression of the bay.

"To this ice-mass I shall give the name of the Baie des Chaleurs glacier. Its source was in the Notre Dame Mountains and principally in the drainage basin of the Restigouche River; but it also drew supplies from the Scaumenac, Nouvelle and Cascapedia valleys. The extreme length of the Baie des Chaleurs glacier was not less than 120 miles. . . . Its width in the Baie des Chaleurs valley, where it was greatest, was 35 to 40 miles, and its extreme thickness was probably 900 to 1000 feet." [2]

Again in 1904 Chalmers devoted his studies to the superficial geology of the region including the Gaspé Peninsula and many of his observations are pertinent to the present study.

[1] Bell, *On the Superficial Geology of the Gaspé Peninsula*, Can. Nat. and Geol. viii. 175 (1863).

[2] Robert Chalmers, Geol. Surv. Can. Ann. Rep. n.s. vii. 88M–90M (1895).

"Most of the coast district between Fox river and Valley river [near Ste. Anne des Monts] is unsettled, except at the fishing stations . . . it forms an undulating plateau from 700–800 feet to 1,200–1,500 feet high, trenched by rivers and brooks, and with a steep face to the gulf. The banks . . . are angular, abrupt, and without that rounded appearance so characteristic of ice-worn surfaces. . . . Inlets at the mouths of rivers and brooks are enclosed between steep, angular bluffs, the upper brow of these being sharp in outline and bearing no traces of ice-action. Nor do the higher hill sides and summits exhibit any erosion by ice, subaerial decay and waste having apparently had full sway here. These features characterize the coast district from Fox river, or Anse au Vallon, to Ste. Anne des Monts, this part of the coast being higher than that to the east or to the west.

. . . . . .

"From Ste. Anne des Monts, . . . westward, the coast scenery changes and becomes less elevated and bold . . . and glaciated blocks, apparently derived from the Shickshock mountains, were also noted . . . and low bosses were observed to be rounded and worn on the south sides, evidently by ice that flowed northward from the mountains referred to. The surface beds here, too, contain large quantities of material derived, apparently, from the interior of the peninsula.

. . . . . .

"The investigations of the past season established the conclusion that, as was first shown by Dr. Bell . . . the glaciation and the transportation of the drift in the Gaspé peninsula, are entirely local." [1]

More recently the great Canadian student of Pleistocene geology, Professor A. P. Coleman,[2] has turned his attention to the Gaspé Peninsula, and although making many observations which slightly modify the deductions of Bell and of Chalmers, in the main his studies corroborate and extend their conclusions. Coleman shows that the Labrador ice-sheet "impinged on the north shore of Gaspé, though not rising upon the higher land, much less scaling the mountains"; that the Baie des Chaleurs glacier of Chalmers was really a lobe of the Labrador ice-sheet which "extended across the St. Lawrence and down the Matapedia valley to Chaleur bay"; that local glaciers from the Shickshock mountains left a "small amount of glacial material" on the high plateau east of Ste. Anne des Monts; and that otherwise glaciation on the Peninsula was local. Coleman's detailed account is replete with significant statements of which the following is a summary.

"There is no evidence that glaciers worked on the highest parts of the Shickshock mountains, for their surfaces consist of loose blocks of the underlying rock, seldom showing any displacement; and no striated surfaces or boulder clay have been found above 2,500 feet. . . . In general it may be said that the effects of local glaciation in Gaspé are not strongly marked. . . . Bell and Chalmers emphasize the frequent occurrence of residual soils where the rock has weathered in place, and most of the surface of Gaspé above the level of marine deposits is of that character. Boulder clay is rarely found, and then only in valleys, and it is mainly the scattered stones derived from the mountains that prove that ice once covered the lower ground. The residual soils and the V-shaped, zigzag river valleys are proofs that the region was only slightly touched by ice."

And, more recently, Dr. Frederick J. Alcock of the Geological Survey of Canada, writes of the fact "that the Shickshock Mountains, though occupied by local glaciers during the Pleistocene, escaped the erosion of the continental ice sheets. A climb to the top of Mt. Albert,

[1] Chalmers, Geol. Surv. Can. Ann. Rep. n.s. xvi. 253A and 254A (1905).

[2] Coleman, *Physiography and Glacial Geology of Gaspé Peninsula, Quebec*, Can. Dept. Mines, Geol. Surv. Bull. 34 (1922).

Tabletop, Lyall, or others is enough to impress any one with this conclusion. The surface is strewn with boulders of the same variety as the bed rock. Along geological contacts there is but little overlapping of boulders. . . . The irregular jagged knobs that project here and there would certainly have been scoured off had an ice sheet advanced over the surface, and there is an absence on the mountain summits of any smooth polished or striated surfaces such as characterize a glaciated region." [1]

These detailed studies show, then, in general an unglaciated condition of the higher levels of the Shickshock Mountains; very trivial glaciation of the coast and valleys from Ste. Anne des Monts to Fox River; only minor glaciation about Percé, where "Except a little boulder clay on the road southwest of Percé no evidence of glacial action was seen, and the mountain, having an elevation of 1,230 feet as shown on the map, must have risen above the ice";[2] and no boulders above 1,200 feet on Carleton or Tracadigash Mountain north of the Baie des Chaleurs. They also show that the Labrador ice-sheet passed down the Matapedia valley to the Baie des Chaleurs; that the Chaleur lobe was fed by local valley-glaciers from the valleys eastward at least to the Grand Cascapedia; that local valley-glaciers extended radially from the walls of the Shickshock Mountains; and that a considerable valley-glacier occupied the head of Gaspé Bay.

In view of the definite localization of the unglaciated or only slightly glaciated areas on the Gaspé Peninsula it is of great interest to note the almost amazing restriction to these spots of many of the plants isolated from western America or of strictly endemic species and varieties. In the flora of the peninsula we know 200 of the plants of table IV, 25 of them endemic species, 11 of them endemic varieties. Thus, the high unglaciated summits and upper walls and chimneys of the Shickshock Mountains are the only known habitats in eastern America for *Polystichum mohrioides*, var. *scopulinum* (map 4). *Athyrium alpestre*, var. *americanum* and *A. Filix-femina*, var. *sitchense*, *Carex scopulorum*, *Streptopus oreopolus* (endemic), *Salix brachycarpa* (map 5), *S. chlorolepis* (endemic) and *S. hebecarpa* (endemic), *Betula papyrifera*, var. *elobata* (endemic), *Stellaria florida*, *Claytonia caroliniana*, var. *sessilifolia*, *Ranunculus pygmaeus*, var. *petiolulatus* (endemic), *Saxifraga gaspensis* (endemic), *Epilobium angustifolium*, var. *platyphyllum* and *E. boreale*, *Vaccinium nubigenum* (endemic), *Solidago mensalis* (endemic), *S. chlorolepis* (endemic), *Antennaria vexillifera* (endemic) and *A. Peasei* (endemic), *Petasites vitifolius*, *Arnica Griscomi* (endemic) and *Agoseris gaspensis* (endemic, map 12); and they also harbor several species which, except for one to few stations (in western Newfoundland, on Anticosti, or other neighboring regions), are essentially restricted to the higher Shickshocks: *Pellaea densa* (map 8), *Adiantum pedatum*, var. *aleuticum*, *Festuca scabrella* (map 7), *Danthonia intermedia* (map 6), *Betula microphylla*, *Arenaria marcescens* (map 11) and *A. cylindrocarpa* (map 13), *Callitriche anceps*, *Epilobium Drummondii*, *Vaccinium ovalifolium* (map 10), *Senecio pauciflorus* and *S. resedifolius* (map 29). Sharing the Shickshocks and the Torngat Mts. of Labrador are *Ranunculus Allenii* (endemic), *Potentilla fragiformis* and *Epilobium Drummondii*.

Very similarly many western or endemic species are confined to the cliffs and steep V-shaped valleys from Ste. Anne des Monts to Fox River, the region emphasized by Chalmers as practically unglaciated and where Coleman describes the valley of Rivière à la Martre which "is cut 700 or 800 feet below the general level and is typically V-shaped. This and the striking re-entrants . . . show that it has never been shaped to any important degree by a valley glacier"; la Rivière aux Marsouins, with "its valley . . . of the same type, deeply cut and V-shaped with bedrock showing at the bottom," and the beautiful Lac Pleureuse, whose "steep shores present well-marked spurs which a glacier would have truncated." This great stretch of essentially

[1] F. J. Alcock, *Across Gaspé*, Geogr. Rev. xiv. 208 (1924).
[2] Coleman, l.c. 23.

unglaciated and bleak coast is rugged, ragged and difficult to traverse, Chalmers well describing it when he wrote: "The roads are the worst in Eastern Canada, especially between Fox river and Sainte Anne des Monts." It is, consequently, almost unexplored, but such very slight examinations as have been made indicate that here is one of the chief regions of Gaspé for localized cordilleran types: *Woodsia scopulina* (Tourelle to Marsouins; map 9), *Agrostis idahoensis* (Lac Pleureuse), *Carex misandroides* (Lac Pleureuse; map 16) *Salix laurentiana* (map 23), *Descurainia Hartwegiana* (Martin River; also Anticosti and Percé), *Astragalus aboriginum* (map 53) and *Oxytropis viscida* (Mt. St. Pierre), *Hackelia deflexa*, var. *americana* (Mt. St. Pierre to Mont Louis; also at Percé and on Tracadigash Mt.), *Artemisia frigida* (Cap. Chat to Mont Louis) and *Arnica gaspensis* (Cap Tourelle).

Again, the cliffs, crests and shores at and near Percé are famous for their western and endemic types: *Puccinellia macra* (endemic, map 26), *Poa Sandbergi* (also on Tracadigash Mt. and at Bic), *Polygonum achoreum*, *Cerastium Fischerianum* (map 62), *Draba pycnosperma* (endemic), *Amelanchier Fernaldii* and *Epilobium glandulosum;* and Tracadigash Mt., although decidedly to the southwest of the other areas and in the midst of a region of heavier glaciation, has a characteristic group of western species about its crests or on its talus, including *Poa Sandbergi*, *Carex Backii*, *Collomia linearis* and *Hackelia deflexa*, var. *americana*.

In many seasons of active botanical exploration on the Gaspé Peninsula, Professors J. F. Collins, A. S. Pease and the writer, occasionally reinforced by Mr. Emile F. Williams or other friends, have repeatedly commented on the abrupt north and south line which separates the interesting flora of the valleys entering the Baie des Chaleurs and of the adjacent headlands from the very ordinary and to the New Englander essentially uninteresting series of plants. So far as explored, the river-valleys and sea-cliffs beginning on the west with the Little Cascapedia and extending east to Gaspé Bay—at least the Little Cascapedia, Bonaventure and Grand (the others being botanically unknown or but slightly explored)—all support a characteristic western or endemic flora, fairly developed along the Little Cascapedia but most concentrated on the Bonaventure and about Percé; the valleys to the west—the Grand Cascapedia, Nouvelle, Escuminac and Matapedia—quite lacking most of these plants. The occurrence as shown from field-notes of many seasons in the southern half of the Gaspé Peninsula of these plants of Table IV is indicated in Table VII.

TABLE VII. OCCURRENCE OF WESTERN OR ENDEMIC PLANTS (OF TABLE IV) IN THE SOUTHERN HALF OF THE GASPÉ PENINSULA

	Gaspé Bay (including lower Dartmouth, York and St. John Rivers)	Percé Region	Grand River	Bonaventure River to Paspébiac Point	Little Cascapedia River	Grand Cascapedia River	Carleton Region (including Tracadigash Mt.)	Nouvelle River	Escuminac River	Matapedia River	Restigouche River
Lycopodium sabinaefolium	×		×		×			×			
Abies balsamea, var. phanerolepis		×									
Juniperus horizontalis		×		×			×				
Potamogeton loculosus	×										
Puccinellia *macra*	×	×									
laurentiana							×				
paupercula, var. *alaskana*	×			×			×				
Poa Sandbergi		×					×				
Agropyron tenerum	×	×		×	×	×	×				
Trisetum melicoides	×	×		×	×	×				×	

TABLE VII—Continued

	Gaspé Bay (including lower Dartmouth, York and St. John Rivers)	Percé Region	Grand River	Bonaventure River to Paspébiac Point	Little Cascapedia River	Grand Cascapedia River	Carleton Region (including Tracadigash Mt.)	Nouvelle River	Escuminac River	Matapedia River	Restigouche River
Agrostis hyemalis, var. geminata					×	×					
Scirpus Clintonii										×	
Carex Deweyana, var. collectanea			×			×					
atratiformis	×	×	×	×	×	×					
concinna		×	×	×	×	×					
Hassei				×		×					
Backii							×				
flava, var. gaspensis	×	×		×	×			×			
Juncus *balticus*, var. *stenocarpus*				×							
Luzula campestris, var. comosa	×										
Zigadenus elegans		×					×				
Iris *setosa*, var. *canadensis*	×	×	×	×	×	×	×	×			
Sisyrinchium montanum			×	×	×						
Epipactis decipiens	×	×					×				
Listera auriculata	×	×	×	×	×	×					
convallarioides		×									
Corallorhiza striata		×									
Salix vestita		×									
myrtillifolia			×	×							
glaucophylloides	×		×	×	×			×			×
Bebbiana, var. capreifolia		×									
paraleuca	×		×								×
Comandra livida	×	×	×	×	×	×		×			
Richardsiana			×								
Rumex *occidentalis*	×		×	×			×	×			
mexicanus	×	×		×	×	×					
Polygonum *Fowleri*	×			×			×				
achoreum	×										
Spergularia *canadensis*	×			×			×				
Arenaria dawsonensis				×			×				
Cerastium Beeringianum		×									
Fischerianum		×									
Ranunculus Purshii				×							
Macounii	×			×							
Thalictrum confine							×				×
Anemone multifida, var. hudsoniana	×	×	×	×	×	×					×
mult., var. Richardsiana			×	×							×
Descurainia Hartwegiana		×									
Draba megasperma							×				
pycnosperma		×									
arabisans	×	×	×				×				
Arabis brachycarpa	×			×			×				
Drosera linearis			×								
rotundifolia, var. comosa			×								
Parnassia parviflora	×	×	×	×	×	×	×				
Amelanchier Fernaldii		×	×								
Potentilla *pectinata*	×	×					×				
pacifica	×	×	×	×	×	×	×	×	×	×	×

TABLE VII.—Continued

	Gaspé Bay (including lower Dartmouth, York and St. John Rivers)	Percé Region	Grand River	Bonaventure River to Paspébiac Point	Little Cascapedia River	Grand Cascapedia River	Carleton Region (including Tracadigash Mt.)	Nouvelle River	Escuminac River	Matapedia River	Restigouche River
Rubus acaulis			×								
Dryas Drummondii	×		×	×	×						
Astragalus eucosmus				×							×
frigidus, var. americanus				×	×						
Hedysarum alpinum, var. americanum	×	×	×	×		×					×
Viola adunca, var. glabra		×					×				
Elaeagnus argentea				×							
Epilobium glandulosum		×									
Osmorhiza obtusa	×	×	×	×	×	×	×	×			
divaricata	×	×	×	×	×	×	×				×
Coelopleurum *lucidum*	×	×						×	×		
Primula farinosa, var. americana		×									
far., var. macropoda	×	×									
Glaux *maritima*, var. *obtusifolia*	×			×							
Halenia deflexa	×	×	×	×	×	×	×	×	×	×	×
Collomia linearis				×	×	×	×				
Hackelia deflexa, var. americana		×					×				
Castilleja pallida, var. septentrionalis		×.	×	×		×					×
Euphrasia *purpurea*	×	×									
purp.*, var. *Randii		×									
Rhinanthus Kyrollae	×	×	×	×	×	×					
Plantago *eriopoda*	×										
Galium Brandegei			×								
Lonicera involucrata				×	×	×				×	
Valeriana sylvatica			×								
Solidago multiradiata	×	×									
lepida, var. molina		×									
lep., var. fallax	×			×							
graminifolia, var. septentrionalis	×			×	×						
Aster foliaceus	×			×	×			×			
fol., var. frondeus				×							
fol., var. arcuans	×										
fol., var. cronifolius			×								
fol., var. subpetiolaris			×								
Erigeron hyssopifolius	×	×	×	×	×	×					×
Antennaria neodioica, var. gaspensis	×	×	×				×	×			
appendiculata			×								
Anaphalis margaritacea, var. occidentalis	×	×	×	×	×	×					
Bidens *hyperborea*	×			×							×
Artemisia canadensis	×	×		×			×				
Arnica chionopappa		×	×	×							
mollis					×	×					
Senecio indecorus							×				
pauperculus			×								
paup., var. firmifolius		×		×							
Taraxacum lacerum		×									
Prenanthes racemosa		×	×	×				×			×
Hieracium canadense, var. hirtirameum				×	×						×

From the tabulation it will be seen that beginning at the west the estuary of the Restigouche (offering superior opportunity for spread of plants) has 19
Matapedia Valley 5
Escuminac Valley (little botanized) 3
Nouvelle Valley 13
Carleton (including unglaciated crests of Tracadigash Mt.) 29
Grand Cascapedia Valley 25
Little Cascapedia Valley 31
Bonaventure Valley (and coast east to Paspébiac Point) 53
Grand River (but once visited) 43
Percé and adjacent headlands 50
Gaspé Bay and lower York, Dartmouth and St. John Rivers 48

In view of the fact, already emphasized by Chalmers and by Coleman, that the valleys of the Grand Cascapedia, Nouvelle, Escuminac and Matapedia were invaded by or were tributary to the Chaleur lobe of the Labrador ice-sheet, while farther east glaciation was local and trivial, these figures and the maps of the occurrence in Gaspé of such very conspicuous cordilleran plants (or their representatives) as *Corallorhiza striata* (map 37), *Dryas Drummondii* (map 38) and *Arnica chionopappa* (map 39), chiefly or wholly upon unglaciated or but slightly glaciated areas, while they are largely absent from closely adjacent but more definitely glaciated regions, can mean only one thing: namely, that *the peculiarly localized colonies of western American and endemic species on the Gaspé Peninsula are relics of the pre-Wisconsin flora which must there have lived essentially undisturbed through the Wisconsin glaciation.* The antiquity and consequently the conservatism of this flora is indicated, furthermore, by the extreme slowness with which most of its species have, since Pleistocene time, occupied the areas immediately to the west which were essentially virgin territory for plant-invasion upon the receding of the Chaleur lobe.

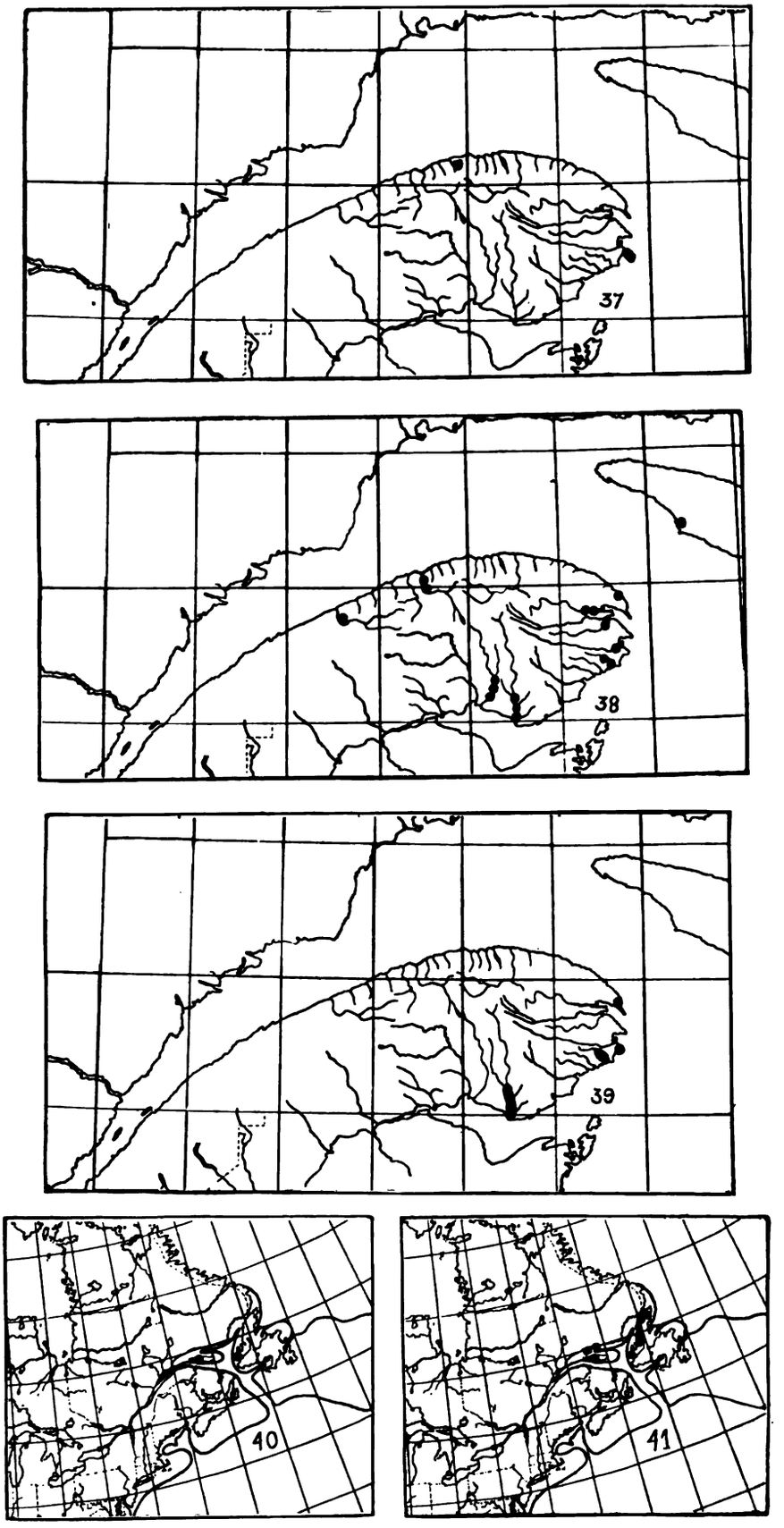
Magdalen Islands

In the summer of 1880 the Canadian geologist, Richardson, studied the Magdalen Islands and in his report wrote: "Nowhere could deposits of clay or gravel be distinguished such as are usually attributed to the drift period. The surface is everywhere covered with a mantle of soil, of similar quality throughout, lying on the upturned edges of the older rocks. . . . The average thickness of these deposits is thus about eight feet, and they are remarkable for their uniform character throughout."[1] Fifteen years later Chalmers wrote: "The Magdalen Islands exhibit the most remarkable non-glaciated condition of any part of the eastern provinces of Canada. . . . Upon the surface . . . lie thick beds of rotted rock *in situ* without any boulder-clay or glaciated material. . . . Indeed, the whole examination of the surface of the four largest islands, viz., Amherst, Entry, Grindstone and Alright failed to show any evidence of glaciation whatever."[2]

Very similarly in 1911, Dr. J. M. Clarke wrote: "The soil of the islands is essentially residual. The islands have never been subjected to glacial action. One finds on the sand spits and on the lower rock platforms, especially of the northern islands, plenty of ice-borne boulders for the most part dropped where they lie, and now glazed by the blown sand, but there has been no disturbance of the soil by ice erosion. Hence the softer red rocks, which are largely felspathic, have undergone deep decomposition in place and, under the vegetable mould at the top, the soil extends downward

[1] James Richardson, *Geological Exploration of the Magdalen Islands*, Geol. and Nat. Hist. Surv. Can. Rep. for 1879–80: 8G, 9G (1881).

[2] Chalmers, Geol. Surv. Can. Rep. n.s. vii. 48M, 49M (1895).



Ranges of (37) *Corallorhiza striata* on the Gaspé Peninsula; (38) *Dryas Drummondii* in eastern America; (39) *Arnica chionopappa* on the Gaspé Peninsula; (40) *Gentiana nesophila;* (41) *Antennaria eucosma.*

often for 5 or 6 feet carrying all the structure of the stratification and passing by evidences of less and less decay into the disintegrating layers of the sandstone and thence into the solid rock." [1]

It was, therefore, quite upsetting to the older view, that the Magdalen Islands show no "evidence of glaciation whatever," when, convinced by his work in Nova Scotia and Cape Breton "that these more northerly islands also had been reached by the continental ice-sheet," Goldthwaite visited the Magdalens in 1913. At the first landing place, Amherst, "a deposit of boulder clay was found within 3 minutes' walk of the pier, and faciated stones were collected from it." [2] From this and the presence of boulder clay on others of the islands, Goldthwaite concluded that, "While final judgment may properly await more thorough field study, enough has been collected in this hurried reconnaissance to make it seem probable, at least, that the islands were covered by ice during one or more of the epochs of the glacial period." [3]

Another chapter in the working out of the Pleistocene history of the Magdalens was reached in 1918 when Professor Coleman visited them "with the object of studying the superficial geology so as to settle the matter if possible." [4] Coleman confirmed, in the main, Goldthwaite's observations, but added the pertinent observation that:

"It was very noticeable, however, that till was confined to the lower levels. Several hills which were climbed, one reaching 360 feet, showed no suggestion of ice action. The higher ones are 'Demoiselle' hills, as described by Clarke, and consist of an agglomerate of some greatly weathered basic eruptive, probably basalt, only loosely coherent and yet with steep slopes, even reaching 30° or 40°. The soil upon them passes down into broken and weathered rock and is clearly residual. It seems improbable that these small hills of loose fragments, with fairly steep slopes, could have been crossed by an ice sheet without any visible effects; and the statements of the earlier observers seem quite justified when the higher parts of the island alone are considered. If an ice-sheet ever crossed the island it must have touched it very lightly, or else have done its work so long ago that weathering has had time to remove completely the evidences of its work."

And Coleman closed his discussion as follows:

"Both islands [the Magdalens and Prince Edward] differ greatly from most other parts of eastern Canada in the small amount of glaciation they display, and in the frequent occurrence of residual soils passing down into rock in place. They were evidently little affected by the passage of land ice over them, if this ever really happened; and one would be tempted to account for the undoubted till deposits as the work of icebergs floating from the margin of the main sheet, if it were not for the fact that the till and the striated stones contained in it are usually of local materials. If the ice-sheet was so thin that low hills of 250 feet were not covered during its advance one can hardly imagine it capable of depositing boulder clay up to 105 feet. Is it possible that the thin edge of the continental ice was afloat, like the Ross Barrier ice of Antarctica, when the sea stood 75, or perhaps 150 feet higher than at present, and that the sandy till with its enclosed bits of sandstone was gathered from rocks on the bottom nearby and left when the ice grounded on the present lowlands of the islands, then shoals covered by shallow water?

"The facts are apparently contradictory and are not easily accounted for by the action of land ice as illustrated in Quebec or Ontario; so that some modification of the glacial machinery, as generally imagined, seems to be necessary.

[1] J. M. Clarke, N. Y. State Mus. Bull. no. 149: 151, 152 (1911).

[2] J. W. Goldthwaite, *The Occurrence of Glacial Drift on the Magdalen Islands*, Can. Dept. Mines, Geol. Surv. Mus. Bull. 14: 6 (1915).

[3] Goldthwaite, l.c. 10 (1915).

[4] A. P. Coleman, *The Glacial History of Prince Edward Island and the Magdalen Islands*, Trans. Royal Soc. Can., Ser. 3, xiii. Sect iv. 33 (1919).

"To an observer from Ontario, all the glacial deposits seen in the east, both on the mainland and on the islands, seem much more weathered and ancient than the glacial deposits north of Lake Ontario, and it may be that they were formed during an earlier and much more extensive glaciation than that of the Wisconsin sheet." [1]

For the purposes of the present study it is quite unimportant, whether the thin ice-sheet which invaded the lower levels of the Magdalen Islands existed in late Pleistocene, early Pleistocene or even earlier. The chief point which comes out very clearly is, that, like some portions of the Gaspé Peninsula, the Magdalen Islands were at most only slightly invaded and that the upper levels have been quite undisturbed by ice. In view of the occurrence on the unglaciated or essentially unglaciated areas of Gaspé of a large isolated western American and endemic flora, it is certainly significant that the little archipelago in the middle of the Gulf of St. Lawrence, in area merely "an outlying scrap of Canada," [2] should in its meagre flora include so many isolated western, endemic or nearly endemic plants: *Epilobium angustifolium*, var. *macrophyllum*, *E. glandulosum*, var. *brionense* (endemic), *Myriophyllum magdalenense* (endemic), *Aster laurentianus*, var. *magdalenensis* (endemic; map 30) and *Bidens heterodoxa*, var. *orthodoxa* (endemic) unknown elsewhere in the East; *Potamogeton filiformis*, var. *Macounii* (map 27), *Aster laurentianus* (typical; map 30) and *Bidens heterodoxa* (typical) known elsewhere in the East only on Prince Edward Island; and others occurring only in one or a few neighboring regions (such as western Newfoundland, Sable Island or Percé); *Juniperus communis*, var. *megistocarpa*, *Rumex maritimus*, var. *fueginus* (see p. 263), *Comandra Richardsiana*, *Amelanchier Fernaldii*, *Empetrum atropurpureum* (see p. 263) *Epilobium nesophilum* and *Mimulus moschatus*.

Prince Edward Island

Much has been written on the geological history of Prince Edward Island, especially in the reports already cited. There is such general agreement in the conclusions that the statement of Coleman may be taken as fairly covering the situation: "The results of the fieldwork done corroborate the conclusions reached by Chalmers that only the northwest end of the island was actually overridden by an ice-sheet coming from New Brunswick or Gaspé; that the rest of the island, especially the central part, was only very slightly touched by ice, if ever completely covered; that the till toward the east end contains only local materials; and that floating ice has distributed foreign boulders over the lower parts of the island." [3] If our reasoning is correct, that the unglaciated or essentially unglaciated areas about the Gulf of St. Lawrence have the larger degree of extreme isolation from the West and of endemism in their floras, we should expect Prince Edward Island, although exposing a much greater land-mass, to have fewer such plants than the less glaciated Magdalen Islands. This is very definitely the case. Prince Edward Island has only 2 strictly endemic plants, *Puccinellia paupercula*, var. *longiglumis* and *Aster cordifolius*, var. *racemiflorus*, both of them variations of common species of the New Brunswick mainland. With the Magdalen Islands it shares *Aster laurentianus* (map 30) and *Bidens heterodoxa* and the western *Potamogeton filiformis*, var. *Macounii* (map 27); and it has two species, *Rumex persicarioides* and *Empetrum atropurpureum*, eastern representatives of western and Andean types and both of local and very interrupted distribution from the Gulf of St. Lawrence to New England. Otherwise its flora is an attenuated mainland flora.

[1] Coleman, l.c. 37 (1919).
[2] Goldthwaite, l.c. 3 (1915).
[3] Coleman, Trans. Roy. Soc. Can. Ser. 3, xiii. Sect. iv. 34 (1919).

Western Newfoundland

Little has been written on glacial phenomena in western Newfoundland. The numerous geological writings of Murray and Howley are non-committal. Milne,[1] summarizing the observations of Jukes and of Murray, pointed out that, "With regard to boulders and *roches perchées*, Mr. Murray and others have noticed that in the southern and western parts of the island these, if they exist at all, are rare, whilst upon the northern and eastern shores they are common," and the conditions in Newfoundland "might be brought under one head by the acceptance of the theory of a radial glaciation preceeding generally from the highlands of the west towards the lower ground in the east, this view doing away with any local glaciation, the anomalies being explained by the radiation. In support of this there is the direction of the striae, and also the fact, deduced from the remarks of Jukes in his 'Excursions in Newfoundland,' vol. ii. pp. 329–340, that the materials of all the erratic blocks and *roches perchées* are to be found in mass upon the island, and at no great distance from their present positions." Kerr[2] showed that in the region from St. John's to Bonavista Bay the striae all trend to the east, mostly to the northeast, and Chamberlain pointed out that the Avalon Peninsula, at the southeast corner of the island, had its own independent glaciation and that, "relative to the interior of Newfoundland . . . the impression was gained that the glaciation of the island was more probably attributable to development of local ice-sheets than to an extension of the ice fields of the mainland";[3] but no special discussion of glaciation of the Long Range seems to have been published until 1912. At that time, however, Twenhofel gave a somewhat explicit account of western Newfoundland and his treatment of glacial phenomena is briefly summarized below.

The Long Range makes on the Gulf side "an abrupt drop of between 1500 and 2000 feet." "Erosion has done extremely little to destroy or modify this precipitous westward-facing scarp, its integrity being well preserved . . . but many small valleys have been cut in the upper portion of the wall at elevations varying with the region, but averaging one-half to two-thirds the height of the cliff. Most of them flare out near their heads and flow on levels having a lesser gradient than lower down in their courses and nearly all of them appear to head in a wall. . . . The upper system of valleys in the Long Range are decidedly U-shaped while the flared-out heads of some of them strongly resemble the descriptions given of cirques. . . . Nearly every one of the valleys shows by the polished rock surfaces that at one time it was filled with the ice. . . . That glaciers covered the western side of the island to the highest summits is certain. . . . The direction of striae on the western foreland leads to the conclusion that the ice movement was controlled by the topography, which is in harmony with the belief that 'Newfoundland seems to have been a separate area of glaciation.' "[4]

Twenhofel also states that "Striae were seen at numerous localities, generally with a direction closely approximating the trend of the valleys of the place in question. Their presence was noted on top of Table Mountain, at Bonne Bay, in the elevated valleys, and numerous places on the foreland."

In four seasons of active botanical exploration on Newfoundland the tremendous contrast between the central barren and tundra area and the summits of the high tablelands of the Long Range, at least from Bay of Islands southward, has greatly impressed the present writer. In the north-central part of the main island, where the railroad crosses from the Humber to the Exploits,

[1] John Milne, *Notes on the Physical Features and Mineralogy of Newfoundland.* Quart. Journ. Geol. Soc. Lond. xxx. 726–728 (1874).

[2] J. H. Kerr, *Observations on Ice-marks in Newfoundland.* Quart. Journ. Geol. Soc. Lond. xxvi. 704–705 (1870).

[3] Chamberlain, *Notes on the Glaciation of Newfoundland,* Bull. Geol. Soc. Am. vi. 467 (1895).

[4] Twenhofel, *Physiography of Newfoundland,* Am. Jour. Sci. ser. 4, xxxiii. 9–18 (1912).

for instance about Quarry, the rocky hills are denuded of decayed rock-mantle and the undulating plateau is a veritable maze of bare ledges, pond-holes, erratic boulders and glacial debris. This condition is conspicuous also on the south coast east of the Long Range. That the region east of the Long Range was severely scoured by the ice there seems no room for doubt. But the high tablelands, at least from Bay of Islands southward, are broad almost prairie-like expanses of truncated and pene-planed rock,—shales, diorites, serpentines, limestones, sandstones, etc.—reaching an average elevation of 2000 feet (610 m.) and sometimes 2700 feet (825 m.) and covered with what to a mere botanist look like frost-broken and long-weathered angular blocks *in situ*.[1]

The writer has not personally visited the high tablelands from Bay of Islands northward (though he has seen them from the water), but Twenhofel's description of Table Mountain at Bonne Bay coincides with the writer's observations southward:

"Table Mountain at Bonne Bay, 2336 feet high, is almost as flat on its summit as a western prairie, the surface rising gently from the margin to the middle. It has been thoroughly shattered by the movements to which it has been subjected, favoring the formation of angular gravel through sun and frost action, and were it not for a mantle of such gravel a bicycle could be ridden with ease on the top of the mountain, a surface stated to have a length of six miles parallel to the coast and four miles in the opposite direction. Its sides are very steep and there are few places where it may be ascended except with difficulty."[2]

So very similar are these high tablelands of the Long Range, with their almost precipitous walls and their deep mantle of angular fragments of the bed-rock, to the nearly perpendicular-walled and deeply mantled tablelands of Gaspé, for instance Mt. Albert in the Shickshocks, that to one with only a minimum of geological training their history inevitably seems to have been essentially the same. Witness Coleman's account of Mt. Albert and compare it with Twenhofel's description of Bonne Bay Table Mountain above quoted: "The mountain [Albert] is really a steeply walled tableland covered with weathered masses of serpentine except for a ridge of garnetiferous hornblende schist which rises a little higher than the rest and has rolled fragments down on the serpentine. It resembles some tablelands in the Torngat mountains of Labrador and seems never to have been crossed by ice, though ice may have moved outward from it;"[3] or again, compare the characteristics of the summit of Mt. Albert pictured by Alcock,[4] Coleman's photograph of "Surface of tableland, not glaciated, mount Innuit"[5] in the Torngat region, and the present writer's photographs[6] of tablelands at Bay of Islands and Port à Port Bay with Twenhofel's account of Table Mountain at Bonne Bay.

The evidence furnished by the deep mantle of angular fragments on the higher tablelands of the Long Range and their abundant V-shaped valleys and ragged and pinnacled crests indicate that the degree of glaciation in western Newfoundland has been greatly over-estimated and, in view of the phytogeographic evidence already discussed in connection with unglaciated or only slightly glaciated areas of Gaspé and the Magdalen Islands it is, therefore, of great significance that the Long Range and its immediate foreland have a flora containing a considerable number (160) of isolated cordilleran or North Pacific species or endemic species of western affinity, although fewer such cases than the Gaspé Peninsula.

[1] Photographs of tablelands of the Long Range, with their characteristic mantles of angular rock-fragments, will be found in Fernald, Rhodora, xiii. pl. 87 (1911).

[2] Twenhofel, l.c. 7, 8 (1912).

[3] Coleman, Geol. Surv. Can. Bull. no. 34: 31 (1922).

[4] Alcock, *Across Gaspé*, Geogr. Rev. xiv. 204, figs. 9 & 10 (1924).

[5] Coleman, *Northeastern Part of Labrador and New Quebec*, Can. Dept. Mines, Geol. Surv. Mem. 124: pl. vi, A (1921).

[6] Fernald, l.c.

Thus, restricted, so far as we know, to western Newfoundland[1] and western America (or Asia) are *Hordeum boreale* (map 24), *Agrostis melaleuca, Juncus longistylis, Sisyrinchium septentrionale, Arenaria peploides*, var. *maxima, Hedysarum Mackenzii, H. alpinum, Epilobium wyomingense* and *Gentiana propinqua*. Unknown east of western America except in western Newfoundland and the Gaspé Peninsula are *Valeriana sylvatica, Senecio resedifolius* (map 29) and *Taraxacum lacerum*. Restricted in the East essentially to western Newfoundland (rarely including adjacent southeastern Labrador), and Gaspé, the Magdalen Islands, Anticosti or the Mingan Islands or occasionally some neighboring station (most species rarely in more than 3 of the areas) are the following western plants: *Adiantum pedatum*, var. *aleuticum, Festuca scabrella* (map 7), *Danthonia intermedia* (map 6), *Salix anglorum*, var. *araioclada, Betula microphylla, Arenaria dawsonensis, Eyrsimum asperum, Drosera linearis, Vaccinium ovalifolium* (map 10) and *Mimulus moschatus*. Sharing western Newfoundland and one or more of the other adjacent areas with the Torngat Mountains and western America are *Salix vestita* (map 15) and *Arenaria cylindrocarpa* (map 13). And the following species, endemic to western Newfoundland or sharing that region with other areas about the Gulf of St. Lawrence or on the Torngat Mountains, are closely related to cordilleran or other western species: *Carex misandroides* (map 16), *Salix leiolepis* (see p. 277), *S. latiuscula* (see p. 278), *S. cryptodonta, S. calcicola* (map 56), *S. anglorum*, var. *kophophylla, Arenaria marcescens* (map 11), *Cerastium terrae-novae* (see p. 250), *Amelanchier Fernaldii, Empetrum Eamesii* (map 33), *Conioselinum pumilum* (see p. 281), *Gentiana nesophila* (map 40), *Antennaria eucosma* (map 41), *A. cana, A. straminea* and *A. albicans* (see p. 284), *Arnica pulchella* (see p. 285) and *A. chionopappa* (see p. 295)[2] and *Taraxacum latilobum*. Furthermore the tiny birch, *Betula Michauxii* of the barrens of Newfoundland and adjacent southern Labrador, although not cordilleran in relationship, departs so far from typical birches in the unlobed bracts of its fruiting aments and its plump and quite wingless nutlets that it has sometimes been treated as an endemic genus, *Apterocaryon* Opiz. The cordilleran plants or species of cordilleran affinity are practically unknown in the region directly east of the Long Range where glaciers unquestionably did vigorous eroding and only 7 of the species are known anywhere east of the Long Range: *Adiantum pedatum*, var. *aleuticum*, by hearsay only from the mountains north of Notre Dame Bay: *Betula borealis*, valley of the Gander; *Arenaria dawsonensis*, island-headlands of Notre Dame Bay; *Empetrum Eamesii*, wide-spread (apparently by ptarmigan) on crests and high barrens; *Epilobium Pylaieanum*, with wind-dispersed seeds, following the south coast from Cape Ray to Cape Race; *Vaccinium ovalifolium*, Notre Dame Bay and White Bay; and *Antennaria straminea*, island-headlands of Notre Dame Bay.

So very similar then, is the phytogeographic relationship of the characteristic flora of the Long Range to that of the Shickshock Mountains and so similar are the deeply mantled high tablelands of the two regions, that, as already stated, it is difficult for a botanist to conceive that the Pleistocene history of the two areas was really very different. Accordingly the problem was stated to Professor Coleman, who, although his plans were made for a summer on the farther side of the continent, so far modified them as to look personally into the glacial phenomena of western Newfoundland. Professor Coleman's published report is not yet available but from a personal letter, written on October 1, 1923, the following extract is made:

"Since I wrote you I have spent a few days in Newfoundland and, in spite of bad weather, made a few climbs which entirely corroborate your conclusions as to the unglaciated character of the Long Range. I had one very fine day on the Cape Ray table mountain, near Tompkins station, and found no evidence of ice action on top, where I went four or five miles across the rolling surface and reached about 2,000 ft.

[1] Rarely also on the north side of the Straits of Belle Isle.

[2] And another local Arnica which came to hand too late for inclusion in Table IV.

"Other climbs convince me that the ice did no work above 1,000, or perhaps only 900, feet. The valleys, however, are usually strongly glaciated.

"There must have been thousands of square miles not covered by ice." [1]

The statement of Coleman that "The valleys, however, are usually strongly glaciated" entirely accords with Twenhofel's account and the limit of general glaciation near Cape Ray at about 1000 feet at once calls to mind Twenhofel's description of the cirques and U-shaped valleys with their ice-worn walls, "situated at altitudes of from 800 to 1200 feet." [2] The striking discrepancy which at once appears, is Coleman's statement that on the tablelands near Cape Ray "the ice did no work above 1,000 feet" and Twenhofel's record of glacial striae "on top of Table Mountain, at Bonne Bay" and his repeated assertion, "That glaciers covered the western side of the island to the highest summits is certain." This discrepency, naturally, is one which a botanist cannot settle; but, in view of the great similarities already emphasized in the gravel-mantles of the admittedly unglaciated tableland-summits of the Shickshocks and the Torngats and those of the Long Range illustrated by the present writer and described by Twenhofel as covering Table Mountain at Bonne Bay, it would seem that the force of the ice on the summit-tablelands in that region was not sufficient to denude them of their angular rock-mantles.

A feature of the high tablelands of Gaspé, Newfoundland and Labrador, especially those with broad prairie-like summits, which is important in this connection, is their absolute exposure to wind. It is the general statement of the guides and hunters who travel in winter over Mt. Albert or the tablelands of the Long Range that the snow rarely lies long on the flat summits, but very promptly blows over the walls, forming deep drifts on the slopes and especially in the valleys. For this reason the caribou promptly take to the summits of the high tablelands in winter, the snow being too deep lower down, but on the summits blowing off and exposing good feeding ground. Every visitor to Mt. Albert or to Blomidon [locally and appropriately known as "Blow-me-down"] on the Bay of Islands in early summer sees evidence of this condition, the summits in full bloom, while over the brows of the cliff-walls the ice and packed snow fill the ravines, to a depth which, on Mt. Albert at least, sometimes approaches 20 feet (6 m.) when the first snows of the next winter begin to fall. Thus only a slight increase for a few years of the mean annual precipitation of the region would today form in the valleys of the Shickshocks or of the Long Range valley-glaciers of appreciable size; and the occurrence of glaciers flowing out from the walls of these mountains, such as Twenhofel's description implies and such as the cirques in the walls of the Shickshocks clearly indicate, would be wholly feasible without any great reduction of temperature.

Even if it should eventually prove that at some points on the Long Range there was sufficient movement of an ice-sheet to produce striae on the high summits far above the cirques and U-shaped valleys or even to transport some boulders, it seems reasonably certain that at many regions of the Long Range there was no appreciable denudation of these wind-swept tablelands of their gravel-mantle; and, just as on the Shickshock tablelands and in other unglaciated, or but slightly glaciated, sections of Gaspé, the plants of remote western relationship in western Newfoundland found spots in which they were able to outlive the glaciation. And, just as in Gaspé these ancient species have rarely migrated far from their special havens, the distinctive plants of western Newfoundland have in post-glacial time failed to take possession of the great area of "arctic tundra" region of central Newfoundland which is closely adjacent and which upon the melting of the ice-cap was virgin territory for plants of pioneering vigor. To some extent, of course, this failure to pioneer is due to lithological differences but many of the distinctive plants

[1] A. P. Coleman in letter to the author, October 1, 1923.

[2] Twenhofel, l.c. 19 (1912).

of the Long Range there freely mingle with the southern coastal plain types[1] which invaded Newfoundland off the now submerged continental shelf which Professor Douglas Johnson and his student, M. A. Stolfus, have recently demonstrated[2] to be geologically a continuation of the southern coastal plain, while they also grow side-by-side with the Arctic plants (of Table I) which pushed south in response to general Pleistocene cold and which apparently are now invading Newfoundland from southern Labrador. Thus at 2000 feet on the high tablelands of the Long Range one can find the coastal plain *Schizaea pusilla* and *Potamogeton Oakesianus* (characteristic plants of the Pine Barrens of New Jersey) quite as abundant as they are in the central and heavily glaciated "tundra"-region; within a radius of a few rods of these coastal plain plants may be collected such Arctic species of wide range over Newfoundland as *Lycopodium Selago, Sparganium angustifolium, Scirpus cespitosus*, var. *callosus, Eriophorum angustifolium, Carex rariflora, Thalictrum alpinum, Salix Uva-ursi, Loiseleuria procumbens, Arctostaphylos alpina, Diapensia lapponica* and *Pinguicula vulgaris;* while mingled with some of them or close by are the cordilleran or endemic *Festuca scabrella* (map 7), *Danthonia intermedia* (map 6), *Carex misandroides* (map 16), *Salix vestita* (map 15), *Arenaria cylindrocarpa* (map 13), *A. marcescens* (map 11), *Valeriana sylvatica, Senecio resedifolius* (map 29), *Antennaria eucosma*, etc. If the plants which have recently invaded Newfoundland, either from the south or from the north, spread extensively over the island and succeed quite as well on the gravels and peats of the Long Range as on the heavily scoured lower areas to the east, it would seem that the failure of the ancient plants of the pre-glacial flora of the Long Range to spread more generally across the island is probably due to their antiquity and consequent conservatism. This situation, then, is quite parallel with the behavior of the ancient flora of Gaspé already discussed in detail.

Anticosti Island

So far as known, the evidence seems clear that Anticosti Island was overridden by glacial ice. Richardson in 1856 made a geological exploration of the island, which is not high, and reported that "the general vegetation of the country is supported by a drift composed for the most part of a calcareous clay, and a light grey or brown colored sand"[3] but Laflamme in his later study of the region definitely states that "These clays are post-glacial. The fossils which I found contained in them . . . amply prove this." However, Laflamme states that "evidences of glacial action are very apparent on studying the pebbles and boulders which are found in every part of the island, even on the highest points. These pebbles are everywhere numerous, some of good size and rather well rounded. They consist of fragments of gneisses, granites, pure labradorite, and other rocks, which evidently come from the north. . . . That the waters of the subsequent period (Champlain) covered the island of Anticosti is amply proved by the presence of the fossiliferous terraces of arenaceous clay, as well as by numerous calcareous pebbles with marks of burrowing by *Saxicava*, etc., which are also found everywhere on the island, both in depressions and on eminences."[4] It is, therefore, worthy of note that Anticosti and the adjacent Mingan Islands, together forming an area one-third the size of the Gaspé Peninsula should have so few of the western plants which characterize the neighboring limestones of Gaspé. In his detailed report on the botany of Anticosti Schmidt[5] enumerates only 27 of the plants of Table IV, one of them, *Salix desertorum*, through error of determination. Of the remaining 26,

[1] See Fernald, Rhodora, xiii. 149–162 (1911).

[2] Johnson & Stolfus, Science, lix. 291–293 (1924).

[3] Richardson, Geol. Surv. Can. Rep. for 1853–56: 198 (1857).

[4] Laflamme, *Geological Exploration of Anticosti*, Geol. Surv. Can. Ann. Rep. n.s. xiv. 192A (1905).

[5] Schmidt, Monographie de l'Ile d'Anticosti, pte. 3 (1904).

several (8), *Juniperus horizontalis, Poa eminens, Zigadenus elegans, Iris setosa*, var. *canadensis, Rumex occidentalis, Cochlearia tridactylites, Plantago eriopoda* and *Senecio Pseudo-Arnica*, are characteristic sea-beach or salt marsh plants of Gaspé, the Magdalen Islands or western Newfoundland and, therefore, to be expected on adjacent shores. Of the 18 remaining, 10, *Trisetum melicoides, Carex atratiformis, Salix vestita, Anemone multifida, Arabis brachycarpa, Parnassia parviflora, Dryas Drummondii, Hedysarum alpinum*, var. *americanum, Halenia deflexa* and *Prenanthes racemosa* have wind-dispersed seeds and are abundant on the neighboring coast of Gaspé and, for the most part, of western Newfoundland. Of the remainder, *Comandra livida, Rubus acaulis* and *Vaccinium cespitosum* are common species of the whole region, with berries or drupes, the types of fruits most often distributed by large birds and by floating. Adding to Schmidt's list such supplementary species as should have been included by him we have the following which are known from Anticosti but not as yet from the Gaspé Peninsula: *Habenaria unalascensis* (map 19), *Arctostaphylos rubra* (see p. 254), *Gentiana nesophila* (map 40), *Aster anticostensis* (see p. 283), *Erigeron lonchophyllus* (map 18) and *Antennaria eucosma* (map 41). Naturally the discovery of any of these is to be expected at any time, especially in the almost unknown region of limestone cliffs and valleys of northeastern Gaspé, since every examination of this region is bringing additional cordilleran species to light and it is equally likely that they will all be found in western Newfoundland, where each visit of a trained botanist brings to light additional cordilleran types. In this connection it is worthy of note that two of the most conspicuous plants of Anticosti, *Gentiana nesophila* and *Antennaria eucosma*, species so conspicuous as not to be overlooked. are endemic to western Newfoundland and Anticosti (the Gentiana also on the adjacent Mingan Islands). In view of the fact that Anticosti was not available to plants until after the receding of the glaciers and that, as Twenhofel defines it, "Anticosti island consists of a part of a cuesta on an ancient coastal plain which . . . existed until the time of the post-glacial submergence,"[1] it is possible that these species (maps 40 and 41) spread to Anticosti by gradual steps from western Newfoundland in post-glacial time before the complete submergence of the continental shelf.

It should, however, be remembered that many western species or allies of western species which are not known from Anticosti are common to Gaspé and western Newfoundland. These include such very obvious plants as *Festuca scabrella* (map 7), *Carex misandroides* (map 16), *Salix anglorum*, var. *kophophylla, Arenaria marcescens* (map 11), *A. cylindrocarpa* (map 13), *Drosera linearis, Amelanchier Fernaldii, Vaccinium ovalifolium* (map 10), *Valeriana sylvatica, Arnica chionopappa, Senecio resedifolius* (map 29) and *Taraxacum lacerum*. Of course some or all of these may yet be found on Anticosti; but in view of the broad and deep channel of the St. Lawrence which separates Anticosti from Gaspé, it is not probable that they have made a post-glacial migration between Gaspé and western Newfoundland *via* Anticosti and the now submerged coastal plain which runs thence to western Newfoundland.

Mingan Islands

Little of a definite character is available regarding the geological history of the Mingan Islands. Like Anticosti they consist of "a part of a cuesta on an ancient coastal plain which . . . existed until the time of the post-glacial submergence,"[2] but I can find no positive statement that they were or were not entirely denuded by the Wisconsin glaciation. Professor Marie-Victorin, who spent some weeks in a botanical survey of the Mingans in 1924 informs me that the landward side of the islands (toward the Labrador Peninsula) shows obvious signs of glaciation, but that

[1] Twenhofel, *The Anticosti Island Faunas*, Can. Dept. Mines, Geol. Surv. Mus. Bull. No. 3: 3 (1914).
[2] Twenhofel, l. c.

these are less pronounced in some other areas. The remarkable mushroom-like or vase-like sculptured rocks which occur in protected places between the islands and which give them a picturesqueness suggestive of the "Garden of the Gods" and other arid regions of the West, might lead to the inference that the islands cannot have been vigorously eroded by the Labrador ice-sheet; but, since these rocks occur at all altitudes from fifty or sixty feet down to the margin of the sea, where they are now being carved by wave-action, it is evident that they are all of recent sculpturing. Richardson's account of them is to the point: "Another feature which marks strongly the change of relative level in regard to sea and land, and tends at the same time to give much picturesqueness to the scenery is the presence of what have been termed flower-pot rocks. These, as the name imports, resemble flower-pots on a large scale. Hundreds of these stand up out of the rising tide to heights varying from ten to fifteen feet, with breadths from a few feet to thirty or forty, widening toward the top. They are composed of horizontal layers of limestone piled on one another, and are the remains of stratified masses that were once united, but have been gradually worn away by the destructive action of the sea, and while many of those standing in the water to various depths according to the state of the tide, show the waves still at work upon them, some straggling ones are seen away high up in the island, showing a similar action when the relative levels of the sea and land were from fifty to sixty feet different from what they are now." [1]

A. P. Low, after studying the neighboring coast of the Labrador Peninsula stated of the great anorthosite area northwest of the Mingan Islands: "On the area of high anorthosite hills between the rivers [Romaine and St. John], striae were found only at the first lake of the portage-route [60 miles inland]. . . . The absence of striae in this region is due rather to the rotted state of the rock surfaces than to the want of glacial action, as there is distinct evidence in the drift and in the rounded outlines of the hills to show that it was ice-covered." [2]

Low also emphasizes the great post-glacial uplift of the Labrador Peninsula, which, opposite the Mingan Islands must have been more than 300 feet, for "The elevation along the Gulf shore of Labrador appears to have increased to the westward. At the Strait of Belle Isle, the highest marine beaches and terraces have an elevation of about 200 feet, while at the mouth of the Saguenay River the highest terraces are more than 600 feet above the level of the river, and in the vicinity of Quebec marine shells have been found 515 feet above the sea, while in the valley of the Chaudière River south of Quebec, Mr. R. Chalmers has traced marine terraces to a height of 895 feet above sea-level. In the valley of the St. John River, deposits of marine clays, overlain by sand, are found continuously for over forty miles inland and to a height of 380 feet above its mouth. Along the Manicuagan River, marine clays can be continuously traced inland for upwards of fifty miles, where they are elevated over 400 feet above the present sea-level. The Betsiamites River, which flows into the Gulf of St. Lawrence about halfway between the Saguenay and St. John rivers, also has terraced banks cut out of marine clays and sands beyond its lowest fall, or more than fifty miles from its mouth and about 400 feet above the sea. . . .

"From the above evidence it will be seen that the post-glacial uplift of the Labrador Peninsula has not been equal around its coast, but that along its southern and western margin it was at least three times greater than along its north and east coast, where 200 feet appears to be the limit of raised marine terraces and beaches." [3]

In view of the fact that Anticosti Island to the south and the mainland to the north of the Mingan Islands apparently were both glaciated and that these regions have been elevated some hundreds of feet in post-glacial time, it is certainly probable that the Mingan Islands have had a similar history.

[1] Jas. Richardson, Geol. Surv. Can. Rep. for 1856: 242 (1857).
[2] Low, Geol. Surv. Can. Ann. Rep. n. s. viii. 293, 294 L (1897).
[3] Low, l. c. 310, 311 L (1897).

The botanical explorations there at different times by Verrill, Saint-Cyr, St. John and Marie-Victorin indicate that 45 of the species of Table IV. occur on the Mingans. 34 of them (such plants as *Poa eminens*, *Rumex occidentalis*, *Parnassia parviflora*, *Coelopeurum lucidum*, etc.) are general around the coasts of Gaspé, western Newfoundland, Anticosti, etc., and are naturally to be expected on the Mingans. 3 of the remaining 11, *Thalictrum confine*, *Dryas Drummondii* and *Prenanthes racemosa*, are characteristic plants of Gaspé and Anticosti, the first with corky fruits adapted for water-dispersal, the two latter with plumose seeds specially modified for wind-dispersal; 2, *Primula farinosa*, var. *incana* and *Senecio Pseudo-Arnica*, var. *Rollandii*, are local variants of species which are general around the Gulf; 1, *Androsace septentionalis*, var. *robusta*, is a variety of a boreal species which occurs on the north coast of Gaspé; 1, *Descurainia Hartwegiana* is on the cliffs of Percé; 2, *Erysimum asperum* and *Gentiana nesophila*, share the Mingans with western Newfoundland (the *Gentiana* also on Anticosti) and might easily have made their way by progressive stages along the old coastal plain from western Newfoundland. The Mingan Islands, however, have two conspicuous species which are (as yet, at least) quite unknown on the demonstrably unglaciated areas of eastern America: *Arctostaphylos rubra* of remote areas across Asia and the region from Yukon along the Rocky Mountains of Alberta; and the remarkable *Cirsium minganense* of the sea-strand, recently discovered by Professor Marie-Victorin and closely related to a group of cordilleran species, *C. foliosum*, etc. The *Arctostaphylos* is also on Anticosti and at the present state of our knowledge we can only suppose that it and the *Cirsium* reached their Mingan and Anticosti stations by migrating along the coastal plain from western Newfoundland. This line of migration is now submerged and the two species may no longer exist in western Newfoundland. The *Cirsium* at least, as described by Brother Victorin, shows none of the agressive traits of the most modern species of thistles. On the contrary it impresses him as an almost extinct species, occurring in one very restricted colony each on three of the Mingan Islands.

Cape Breton Island

In 1911, while returning from Newfoundland, Professor K. M. Wiegand and the writer found themselves stranded for the day at Sydney, Cape Breton. During a walk, cliffs were noticed along shore covered with a loose and readily detached crisp coat of thoroughly decomposed rock. A photograph and specimens brought the quick explanation from Professor J. B. Woodworth that we had found an area from which the rotted surface had never been eroded. The incident was forgotten until, in the letter from Professor Coleman regarding the Long Range, he said:

"On my way back I found a considerable unglaciated area at the northeast end of Cape Breton island. Here the ice probably reached no higher than 500 feet, and there are many square miles above 1,000 feet. Inverness is a good point to visit an unglaciated area."[1] The occurrence of the western *Epipactis decipiens* (map 20) and *Osmorhiza divaricata* (map 21) and of the extremely localized *Empetrum Eamesii* (map 33) has already been noted. The northern half of Cape Breton is likewise well known for some boreal species, like *Thelypteris Filix-mas*, *Polystichum Lonchitis*, *Selaginella selaginoides*, *Sparganium hyperboreum* and *Poa alpina*, which in eastern America are otherwise largely or wholly concentrated in western Newfoundland, Gaspé and the Magdalen Islands. It likewise shares with these areas or with Sable Island or the Avalon Peninsula of southeastern Newfoundland, a considerable Atlantic European but not boreal flora. The detailed discussion of the latter element in the flora of Newfoundland and the region about the Gulf of St. Lawrence would take us too far from the consideration of western types. But the occurrence on Cape Breton of such plants as well as of those above enumerated

[1] A. P. Coleman in letter to the author, October 1, 1923.

and the presence there of areas which were not denuded by the glaciers of their ancient mantle of decayed rock at once suggest the importance of further explorations in the region.

Bic

The north-facing cliffs which form a sea-wall interrupted at Bic harbor are not technically a part of the Gaspé Peninsula, beginning 35 miles (55 km.) west of Métis and extending westward for several miles in Rimouski County, Quebec; but on account of the great similarity in their topography and flora to the sea-wall farther east they have been entered in Tables I–IV as "Gasp 48." A somewhat lower extension of this wall reaches Trois Pistoles in eastern Temiscouata County and, although not yet botanically investigated, it will presumably show botanical features similar to those known from Bic to St. Fabien.

In describing the glaciation of eastern Quebec Chalmers said of the region of Bic and Trois Pistoles: "At what height the land stood here at the maximum extension of the ice is uncertain . . . but it was probably as high, if not higher, than at the present day. The striae on this slope trend from N. 64° E. at Montmagny to due N. to N. W. at Trois Pistoles, Bic, etc., and in other places to N. 50° W., indicating a wide range in the movements, due chiefly to the inequalities of the surface and to the fact that the glaciers followed the local valleys." [1]

The higher crests between Bic and St. Fabien are 700–900 feet (215–275m.) above the St. Lawrence. They consist of extremely hard and slow-weathering quartzites, limestones and limestone-conglomerates and are characterized by sharp and often overhanging edges with ragged pinnacles, towers and cusps, thus presenting contours quite in contrast with the smoothed-off outlines in heavily glaciated regions and, even though small glaciers from the south followed out to the St. Lawrence through the local valleys, it seems improbable that these ragged crests were crossed by vigorously eroding glaciers. At any rate it is worthy of note that Professor J. F. Collins and the writer in exploring eastern Canada have found the crests and cliffs at St. Fabien and Bic a prolific region for isolated cordilleran or other western plants and for endemics. Botanizing in such areas is difficult and exhausting and only a small proportion of these crests and walls have been explored and it is quite certain that the headlands westward into Temiscouata County will yield their specialties, but the following result from the headlands of Bic is significant. 73 species of Table IV are localized about Bic. The isolated northeastern limits of *Woodsia oregana* (map 17) *Arabis Collinsii* (p. 252), *Dracocephalum parviflorum* and *Leucophysalis grandiflora* are there; and there occur *Carex concinna*, *Comandra Richardsiana*, *Arenaria dawsonensis*, *Stellaria borealis*, var. *Bongardiana*, *Cerastium Beeringianum* and *Osmorhiza obtusa* which have their chief eastern centers in Gaspé and western Newfoundland; and *Poa Sandbergi*, *Epipactis decipiens*, *Elaeagnus argentea* and *Senecio indecorus* which are plants of Gaspé but not of Newfoundland; while the endemic *Rosa Williamsii* grows on the dry ledges with *Woodsia oregana* and *Poa Sandbergi;* the endemic *Antennaria subviscosa* on shelves with *Carex concinna*, and an endemic *Arnica* (known only in foliage) occupies one of the crests. There also is a large western element which has not been specially enumerated in Table IV since the species are not so strictly localized in the East as are those admitted to the Table or because, occurring also in Europe or to the north of the Gulf of St. Lawrence, they find a place in Tables II and III: such species as *Botrychium Lunaria*, *Calamagrostis purpurascens*, *Orchis rotundifolia*, *Chenopodium capitatum*, *Corydalis aurea*, *Draba aurea*, *Arabis Holboellii*, *Viola nephrophylla* and *Taraxacum ceratophorum*.

[1] Chalmers, Geol. Surv. Can. Ann. Rep. n. s. vii. 89M (1895).

GLACIATION OF THE TORNGAT MOUNTAINS

With their pinnacled and jagged crests and their broad tablelands of angular rock-debris the high mountains of northeastern Labrador have been longer recognized than any other region of eastern America as a "driftless" region. In 1860 Lieber, in mapping the coast near Cape Chidley, sketched "wild volcanic looking mountains," [1] "whose craggy peaks have evidently never been ground down by land-ice into domes and rounded tops." [2] In 1884, Dr. R. Koch, who had spent the winter of 1882–83 at Nain wrote: "The highest points of this range are opposite the island of Aulatsivik, and reach elevations of from 8,000 to 9,000 feet. While mountains less than 1,500 or 2,000 feet in height are rounded, and bear evidence of having been covered by glaciers, the ragged forms of the higher mountains show no such signs." [3] In 1884 Dr. Robert Bell estimated the highest land on the coast at 7.000 feet and writing of Nachvak he said: "The mountains around Nachvak are steep, rough sided, peaked and serrated, and have no appearance of having been glaciated, excepting close to the sea-level." [4] Somewhat later, Daly, in reporting upon a summer of geological exploration wrote: "I was able to confirm Dr. Robert Bell in the proof . . . that an overwhelming general glaciation of the Torngats, such as occurred in the White, Green, and Adirondack Mountains, did not take place in the last glacial epoch. The ice of that period moved seaward from the *névé* of the interior of Labrador through the transverse valleys and passes of this range, and seldom, if ever, submerged the mountains above the 2,100 [foot] contour." [5] And in 1921, Coleman, although differing in some details from Daly (especially in maintaining that the glaciation of the low slopes was purely local and not due to movement "seaward from the *névé* of the interior") agreed that, "The evidence of glacial action is absent from a considerable area in northeastern Labrador, since the higher tableland and the tops of the mountains which fringe it on the Atlantic side show no marks of having been overridden by an ice-sheet. The area left unglaciated cannot yet be exactly outlined . . . but it is known that along a coastal belt extending from Saglek to Komaktorvik, a distance of 80 miles, there is no appearance of ice action above the valleys. At Nachvak this unglaciated condition is known to reach at least 50 miles inland, giving a 'driftless area' of perhaps 3,000 or 4,000 square miles. The tops of Kiglapait and Kaumajet mountains to the south and of the Four Peaks to the north, as well as many other isolated peaks, probably rose as nunataks above the surrounding ice." [6]

Our knowledge of the flora of the high mountains of northeastern Labrador is very incomplete, since no trained systematic botanist has yet visited that region, but many collections have been made by the Moravian Brothers, and by Sornborger, Bell, Delabarre, and others who have thus given us a good general knowledge of the region. Of course the more generally dispersed arctic types are there but the Torngat region at once stands apart from the rest of the Labrador Peninsula on account of the cordilleran species isolated there. Several of these were enumerated in the first half of this paper and several others immediately come to mind. Thus, restricted in the East to the Torngat region or extending very locally southward are the following cordilleran species; *Carex filifolia* (see p. 252), *Draba stenoloba* Ledeb., *Pedicularia groenlandica* Retz.,[7] *Petasites*

[1] Lieber, O. M. *Sketch showing the Geology of the Coast of Labrador*, U. S. Coast Surv. Rep. for 1860 App. No. 42, Sketch no. 38 (1861).

[2] Packard, The Labrador Coast, 8 (1891).

[3] Koch as quoted by Packard, The Labrador Coast, 228 (1891).

[4] Bell, Geol. and Nat. Hist. Surv. Can. Rep. for 1882–84, 14DD (1884).

[5] Daly, Bull. Geogr. Soc. Phila. iii. 210 (1902).

[6] Coleman, *Northeastern Part of Labrador and New Quebec*, Can. Dept. Mines, Geol. Surv. Mem. no. 124: 26 (1921).

[7] Although its specific name suggests that *Pedicularis groenlandica* is a Greenland plant, the species is known only from Labrador, the west coast of Hudson Bay and the Rocky Mountain region. The original material was carried to Europe by Moravian missionaries who collected in both Labrador and Greenland and the data was obviously confused.

sagittata (Pursh) Gray and *Crepis nana* (map 14). Sharing the Torngat Region with the Cordillera and with areas in Gaspé or Newfoundland (and rarely adjacent spots) are *Salix vestita* (map 15), *Arenaria cylindrocarpa* (map 13), *Astragalus eucosmus, Viola adunca*, var. *glabra, Epilobium Drummondii* and *Senecio pauciflorus;* and endemic to the Torngat region are several species with their affinities clearly with cordilleran plants: *Antennaria Sornborgeri* Fernald, *A. pygmaea* Fernald, *A. isolepis* Greene, *Arnica Sornborgeri* Fernald, *A. plantaginea* Pursh, etc.

These cordilleran plants or endemic allies of cordilleran plants isolated on the Torngats and neighboring unglaciated mountains of northeastern Labrador are enough to stimulate the imagination of any keen botanical explorer, especially since such plants as *Carex filifolia*, collected by Delabarre at Nachvak, are characteristic of the more arid regions of the West. In view of Coleman's account of the warm and dry chinook winds "like those of Alberta" and of the suggestion in the vegetation of the inner valleys of "a dry climate like that of the ranch country of Alberta," it is justifiable to predict a considerable flora of cordilleran type awaiting the trained botanist who can spend several seasons on the Torngat Mts.

GLACIATION ABOUT THE UPPER GREAT LAKES

Although somewhat outside the area specially discussed in this paper, the region about the upper Great Lakes has been emphasized as one in which numerous plants of western America have localized colonies. Some of these plants, especially of Keweenaw Peninsula and Isle Royale in Lake Superior and Bruce Peninsula on Lake Huron, but sometimes with considerable areas elsewhere in northern Michigan or in Ontario, are species which are again localized about the Gulf of St. Lawrence: such, for instance, as *Pellaea densa* (map 8), *Woodsia scopulina* (map 9), *Vaccinium ovalifolium* (map 10), *Woodsia oregana* (map 17), *Habenaria unalascensis* (map 19), *Epipactis decipiens* (map 20), *Osmorhiza divaricata* (map 21) and *Arenaria macrophylla* (map 31); again, there are species of the Pacific slope, such as *Bromelica Smithii* (p. 256), *Oplopanax horridum* (map 22), *Rubus parviflorus* (p. 256) and *Ceanothus sanguineus* (p. 256), which have about the upper Great Lakes their only known stations east of the northern Pacific slope of Nortb America.

All geologists whom the author has consulted are in agreement, that the shores of the Great Lakes were all eroded or covered in the Wisconsin glaciation and even that some of the region (Isle Royale, for example) has been submerged beneath the surface of the lakes. It would, therefore, be hardly justifiable to account for these plants of the Pacific slope isolated on Isle Royale, Isle St. Ignace, Keweenaw Peninsula or Bruce Peninsula as relics which there outlived the Wisconsin glaciation. There is, however, beginning 110 miles (177 km.) south of Lake Superior and 80 miles (129 km.) southwest of the head of Green Bay, one of the most famous unglaciated regions within the general area of North America which was invaded by the Keewatin and Wisconsin ice. The detailed studies of the region are thus briefly summarized by Chamberlain and Salisbury. "A considerable area in southwestern Wisconsin, and the adjacent parts of Illinois, Iowa, and Minnesota, is without drift"; while Alden[1] points out that to the north, west and south of the driftless area much of the region was invaded by glaciers only long before the Wisconsin glaciation. This driftless area and the eastern margin of the region of pre-Wisconsin drift (map 42) is now, of course, too hot and dry for the plants which occupy the headlands and peninsulas of Lake Superior but, centering on this region, though commonly ranging slightly beyond it, are a considerable number of remarkable endemics: such, for instance, as *Asclepias Meadii* Torr. (map 43), one of the rarest of species; *Talinum rugospermum* Holzinger (map 44) and *Lespedeza*

[1] W. C. Alden, *The Delavan Lobe of the Lake Michigan Glacier of the Wisconsin Stage of Glaciation.* U. S. Geol. Surv. Profess. Paper, No. 34, pl. iii. (1904).

leptostachya Engelm. (map 45), also excessively local species; while others, like *Quercus ellipsoidalis* E. J. Hill (map 46), have occupied a larger area outside.

In view of the fact that this well known area which was not invaded by Wisconsin ice is a definite center for plants of limited range, which there apparently outlived the Wisconsin glaciation, it seems reasonable to suppose that the western plants which are now isolated about the Great Lakes (and particularly about Lake Superior and the northern half of Lake Michigan) found refuge during the maximum of Wisconsin glacial conditions in the driftless or undisturbed area south of Lake Superior and, upon the melting of the ice, the general increase of temperature and the uncovering of the headlands of northern Michigan, withdrew to these hospitable areas. Such an explanation finds support, also, in the fact that the western plants which are isolated about the Great Lakes and again about the Gulf of St. Lawrence have shown in the latter region a positive ability to spread away from the unglaciated spots to adjacent glaciated areas; while the plants of the West which are isolated about the Gulf of St. Lawrence but unknown about the Great Lakes have been far more conservative. Thus, of the western plants which are isolated eastward both about the Great Lakes and the Gulf of St. Lawrence 80% have spread in the latter region at least slightly into the unglaciated areas while some, such as *Carex atratiformis*, *Epipactis decipiens* (map 20), *Arenaria macrophylla* (map 31) and *Osmorhiza divaricata* (map 21) have reached New England. Contrasted with this situation we have the fact that (excluding the strictly maritime plants) of the western types which occur about the Gulf of St. Lawrence without an intermediate area on the Great Lakes only 35% have shown any tendency in the East to spread away from the unglaciated spots; and most of these, like *Potamogeton filiformis*, var. *Macounii* (map 27), *Festuca scabrella* (map 7), *Dryas Drummondii* (map 38), *Osmorhiza obtusa* (p. 290), *Gentiana nesophila* (map 40) and *Antennaria eucosma* (map 41), have not yet got far from the unglaciated centers.

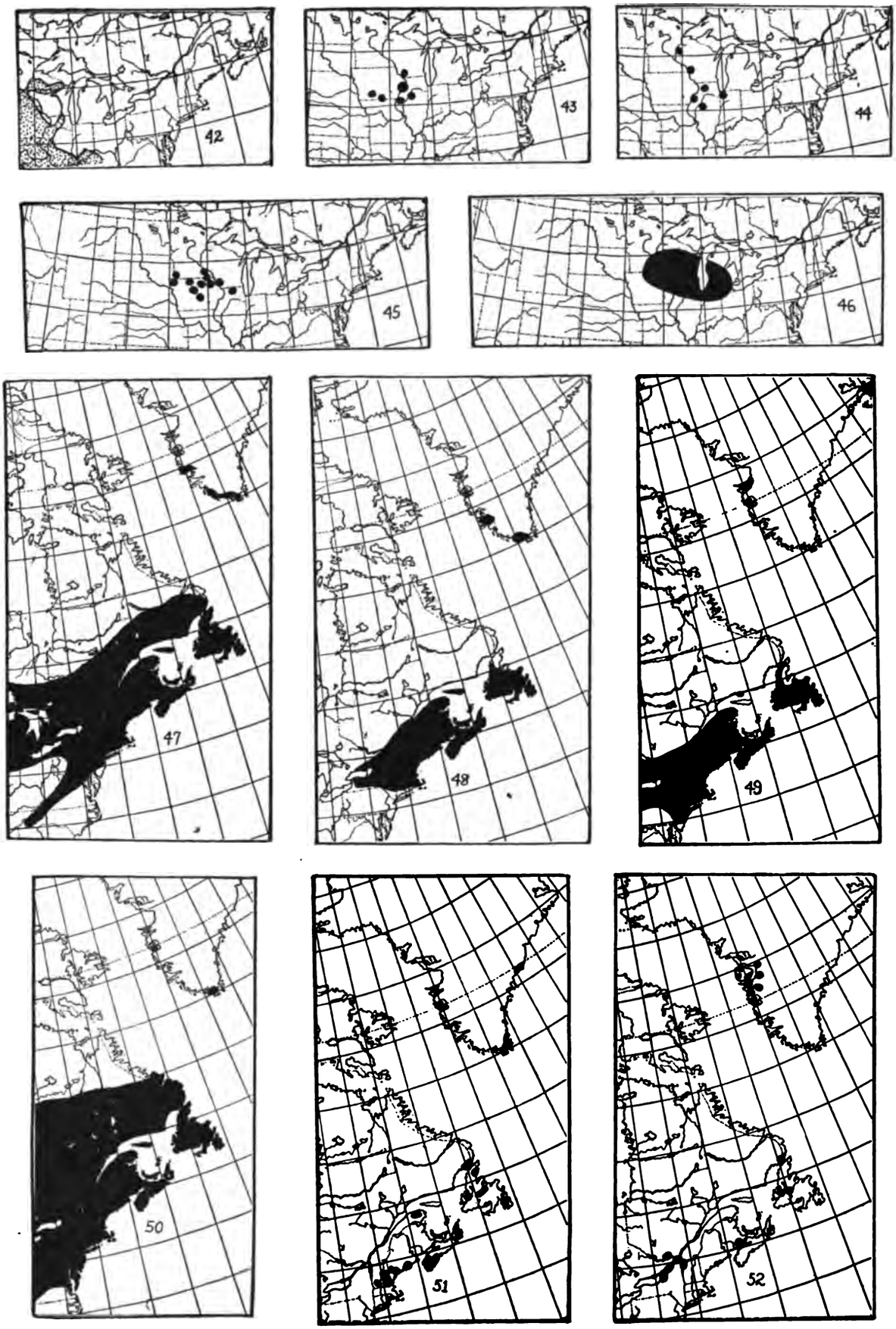
GLACIATION OF NORTHWESTERN AMERICA AND OF ASIA

The plants which have been specially considered in this paper are types belonging chiefly in or related to plants of the Cordillera, the region of the North Pacific or eastern and central Asia. In view of the tremendous effects of continental glaciation in the region between the eastern mountain-rim of Labrador and the Rocky Mountains and south across the northern states, it is significant to note that west of the Plains glacial conditions have been more like those in the Torngat Mountains, the Long Range and the Shickshock Mountains. The following brief excerpts from the summary-statements of Chamberlain & Salisbury are sufficient to make this point clear.

"In some sense, the whole Cordilleran ice-sheet was the product of a confluence of mountain glaciers deploying on the intervening plateau; but there appears to have been plateau glaciation not solely dependent on contributions of ice from the mountains. . . . The northern lobes descended the valleys tributary to the Yukon, but so far as known, did not cross the Canadian boundary into Alaska. . . . On the west, the plateau ice-cap seems to have sent tongues of ice through the gaps in the coast ranges at many points, and to have discharged thence into the Pacific . . . the plains of Alaska seem to have been free from glaciation even at the stages when the waters of the Ohio and the Missouri were being turned from their courses by encroaching ice-sheets.

"Alaska was largely free from ice except on or about the mountains, and continuous glaciation did not extend as far south on the mountain-girt plateaus of the Pacific border as on the smooth, low plains of the Mississippi valley. Much the greater part of the 4,000,000 square miles of the ice-fields lay on the plains of Canada and in the upper Mississippi valley." [1]

[1] Chamberlain & Salisbury, Earth Hist. iii. 330–333 (1906).



Location of (42) Driftless Area of Wisconsin and adjacent states (undotted ellipse) and Area of pre-Wisconsin Drift (dotted), after Alden. Ranges of (43) *Asclepias Meadii;* (44) *Talinum rugospermum,* (45) *Lespedeza leptostachya,* (46) *Quercus ellipsoidalis,* after Hough. Ranges in eastern America of (47) *Galium triflorum,* generalized; (48) *G. palustre,* generalized; (49) *Utricularia intermedia,* generalized; (50) *Drosera rotundifolia,* generalized; (51) *Subularia aquatica;* (52) *Callitriche hermaphroditica.*

"With the exception of a portion of the Siberian tract, all the Asian glaciation was associated with high latitudes." [1]

Central and eastern Asia have long been recognized as a home of ancient types of plants and the Altai region as a centre of endemism and of extreme isolation. Alaska and adjacent British Columbia, too, form a well marked region for localized types, as do various regions to the south and east. The interest of these facts in the present case is, that so many plants of the Altai or of eastern Asia should be localized in America in regions where there was no general continental glaciation or (as in case of the Great Lake area) in regions closely adjacent to unglaciated areas of considerable size. The plants of such isolated occurrence have been so fully discussed in this paper that their reenumeration is unnecessary.

OCCURRENCE OF PLANTS IN PROXIMITY TO GLACIERS

Grave doubt has been expressed to the writer by several geologists as to the possibility of plants living through the time of maximum glaciation so near to ice-fields as would have been the plants of the Wisconsin "driftless area" or those of the Shickshock Mountains, the Long Range or the Torngat Mountains. But to those who know the conditions in glacial regions of the present time the Gaspé Peninsula or the Torngat Mountains, with local valley glaciers and a general sheet of ice only on the lower levels, would seem to have been no more forbidding for plants than are the top of the Malaspina Glacier and other shores of Yakutat Bay or the mountains about Prince William Sound in Alaska, with an abundant flora including many of the very species which occur in Gaspé. And, if ice-buried Greenland can support along its narrow rim today 416 species of vascular plants, a large proportion of which reach western Newfoundland or Gaspé, certainly the latter regions during their local glacial periods, with comparatively thin and local ice-sheets and with much of the area above the level of lasting ice, must have been able to support a large boreal flora.

As a matter of fact the flora of Greenland, a vast area (more than 800,000 square miles) which is now in the midst of a continental glaciation, contains an amazing number of species which belong to decidedly *temperate* rather than frigid regions. Of the 416 species of vascular plants known in Greenland,[2] 279 (67% of the Greenland flora) also occur south of the St. Lawrence and the Straits of Belle Isle, 243 of them (58½% of the Greenland flora) being known at or near sea-level; 100 species of Greenland (24% of its flora) are found in southern New England (Massachusetts, Rhode Island or Connecticut); and 26 species known in Greenland (6% of its flora) extend south to the region of Washington, D. C.,—such plants as *Equisetum arvense* L., *Lycopodium clavatum* L., *Deschampsia flexuosa* (L.) Trin., *Eleocharis acicularis* (L.) R. & S., *Carex canescens* L., *C. rostrata* Stokes, *Nasturtium palustre* (L.) R. Br., *Drosera rotundifolia* L., *Callitriche palustris* L., *Epilobium angustifolium* L. and *Galium triflorum* Michx. Furthermore, 75 species which occur in Greenland (18% of its flora) reach their northeastern limit of range in North America (outside of Greenland) at or near the Straits of Belle Isle, their northern limits varying from lat. 48°–54°. This large element in the Greenland flora, which is unknown in eastern America north of Gaspé, Newfoundland or southern Labrador, contains many of our most distinct and conspicuous species, so conspicuous that they could not have failed to attract the attention of those who have explored northern Labrador and Baffin Land if their ranges actually extend far north of their known limits in eastern America; such plants as *Polystichum Lonchitis*, *Thelypteris Filix-mas*, *Athyrium alpestre*, *Botrychium Lunaria*, *Lycopodium tristachyum*, *Carex*

[1] Chamberlain & Salisbury, l.c. 328 (1906).

[2] The list of Greenland plants has been compiled from a full series of maps of ranges in Greenland kindly presented to the author by Dr. Morten P. Porsild of the Danish Biological Station at Disco.

pratensis, *C. Buxbaumii*, *C. Oederi*, *Orchis rotundifolia*, *Corallorhiza trifida*, *Sagina nodosa*, *Stellaria borealis*, *Ranunculus reptans*, *Coptis trifolia*, *Thalictrum alpinum*, *Arabis Holboellii*, *Viola Selkirkii* and *Menyanthes trifoliata*. The present situation is clearly shown by the maps of *Galium triflorum* (map 47), *G. palustre* (map 48), *Utricularia intermedia* (map 49), *Drosera rotundifolia* (map 50), *Subularia aquatica* (map 51), and *Callitriche hermaphroditica* (or *C. autumnalis*) (map 52), all characteristic plants at low altitudes in New England or New York; and the same relationship would be shown if the ranges of the remaining 69 species were mapped. Obviously, then, if 26 vascular plants of the District of Columbia, 100 of southern New England, and 243 of low altitudes south of the St. Lawrence occur today on the margin of ice-capped Greenland, there making up nearly 60% of the flora, it should not strain the imagination to picture plants of boreal habitats outliving the comparatively slight glaciation which existed in the region bordering the Gulf of St. Lawrence.

In regard to the 3 endemic species of the White Mountains of New Hampshire, a region in which the Canadian ice-sheet is stated to have pushed over the summit of Mt. Washington, it is quite possible that these are ancient types which survived the maximum glaciation in some protected spot or spots in the region. *Geum Peckii*, closest related to *G. calthifolium* Menzies of the North Pacific region, and *Potentilla Robbinsiana*, closely related to *P. frigida* Vill., of the high Alps and Pyrenees of southern Europe, at once challenge attention as species not belonging to nor clearly derived from the wide-ranging circumpolar flora which invaded Europe, Asia and America from the Arctic. The evidence seems to indicate that the great "gulfs" of the White Mountains were glacial cirques out of which radiated local valley glaciers, and it seems quite possible that in some sheltered pockets in their upper walls a few alpine species were able to survive the Wisconsin glaciation.

ZOOLOGICAL EVIDENCE

Although no definite effort has been made to find cases of localization about the Gulf of St. Lawrence or the Great Lakes of animals primarily of cordilleran or Pacific range, in the course of this study a few cases have come to light which it is worth while to enumerate.

In 1858 Dr. J. W. Dawson noted a barnacle from Gaspé Bay, which belongs apparently to an isolated fauna:

"*Coronula Reginae* (Darwin).—On shreds of skin of the humphback whale in one of the whale houses [on Gaspé Bay], we found a specimen . . . of this species, hitherto obtained only from the Pacific." [1]

Scharff, basing his note on a paper by Bryant Walker, thus discusses the fresh-water pearl-mussel, *Margaritana margaritifera:* "In North America it occurs within the ancient eastern land-mass in several localities, notably in Labrador, on Newfoundland and Anticosti Islands, in the Quebec province and in New England. From its western station in the lower Saskatchewan it is separated by a tract of over one thousand two hundred miles in which it is unknown." [2]

In 1906, Dr. J. H. Wilson, in describing pre-Wisconsin deposits on Nantucket, says of some of the fossil Mollusca: "Of these a number were identified by Dr. W. H. Dall. . . . The identification of *Serripes laperousii* Deshayes, *Macoma incongrua* von Martens, and *Pandora crassidens* Conrad, was a surprise, as the first two belong to the arctic fauna of the Pacific coast, and, according to Dall, have not heretofore been found east of Point Barrow. . . . The two Pacific species would seem to indicate that in Pleistocene times the 'Northwest Passage' was more

[1] J. W. Dawson, Can. Nat. and Geol. iii. 329 (1858).
[2] Scharff, Distribution and Origin of Life in America, 51 (1912).

open than at present, and perhaps also that in an interglacial period in which these beds were deposited the ice had entirely disappeared from even the northern part of the continent."[1]

In 1912 Mr. Bayard Long accompanied the present writer and Messrs. E. B. Bartram and Harold St. John on a botanical trip to Prince Edward Island and the Magdalen Islands. Mr. Long assiduously collected land snails at intervals between the botanizing. In reporting upon this collection Vanatta says: "The snail fauna seems to be the usual northern type with the addition of the European *Helix hortensis* Mull., *Hygromia hispida* L., and a new *Succinea* related to western American forms." Then follows a description of *Succinea bayardi* from Prince Edward Island, "very closely related to *Succinea oregonensis* Lea."[2]

Lastly, my student, Mr. Philip Darlington, calls my attention to an account of the Coleoptera of Michigan in which Dr. John L. LeConte wrote: "Especially worthy of notice is the large proportion of species common to Lake Superior and Alaska. . . . The occurrence at Lake Superior of *Euthia scitula* and *Syntomium confragosum* previously known only from Alaska, and *Gonotropis gibbosa* from Colorado, deserve mention."[3]

It is thus clear that at least the invertebrate fauna, like the flora, of the regions centering on the Gulf of St. Lawrence and Lake Superior has its isolations from the West.

POSSIBILITY OF DISPERSAL PRIOR TO THE WISCONSIN GLACIATION

In differentiating the cordilleran and other western plants which occur about the Gulf of St. Lawrence or on the Torngat Mts. from the arctic species which there reach their southern limits great difficulty is encountered. Such a plant as *Crepis nana* (map 14), with its greatest development and variation on the Cordillera south of lat. 53°, but with another center near the Arctic Circle, and outlying stations on the Torngats, in western Alaska and on the Altai, is a good illustration of the impossibility of sharply differentiating the ranges. Similarly, *Astragalus aboriginum* (map 53), characteristic of the dry mountains and high plains from Yukon and Mackenzie to Colorado, is known in the East only on dry calcareous talus at the foot of Mt. St. Pierre, Gaspé County, Quebec, where it abounds with the similarly isolated *Oxytropis viscida;* but it is an arctic plant,[4] occurring on Banks Land and Victoria Land as well as on the Arctic coast of the mainland. *Erigeron compositus* (map 54) has a similar range, but with its cordilleran area more to the southwest, its arctic range more to the northeast, extending to Melville Island, Ellesmereland and Greenland. *Lesquerella arctica* (map 55), centering on the Arctic Archipelago and Greenland, has a remote outlying station on the Athabasca River in Alberta[5] and others on the Torngat Mts. and on the limestone-barrens of western Newfoundland and Anticosti. *Salix Richardsoni* (map 56), a unique species of Alaska, Yukon and Mackenzie and eastward along the Arctic coast to the base of Melville Peninsula, is represented farther eastward and southeastward (about Hudson Bay, in Baffin Land, on the Torngats, in western Newfoundland and Gaspé) by *S. calcicola,* which by some authors has been considered specifically identical with *S. Richardsoni* (var. *Macouniana* Bebb). *Dryas integrifolia* (map 57), one of the most widespread plants of the Arctic Archipelago, extends from Bering Straits around the Arctic to Baffin Land and northeastward to Ellesmereland and Greenland; south of the Arctic it has outlying areas along the Rocky Mountains to southern Alberta, about James Bay, on the Torngats and locally south-

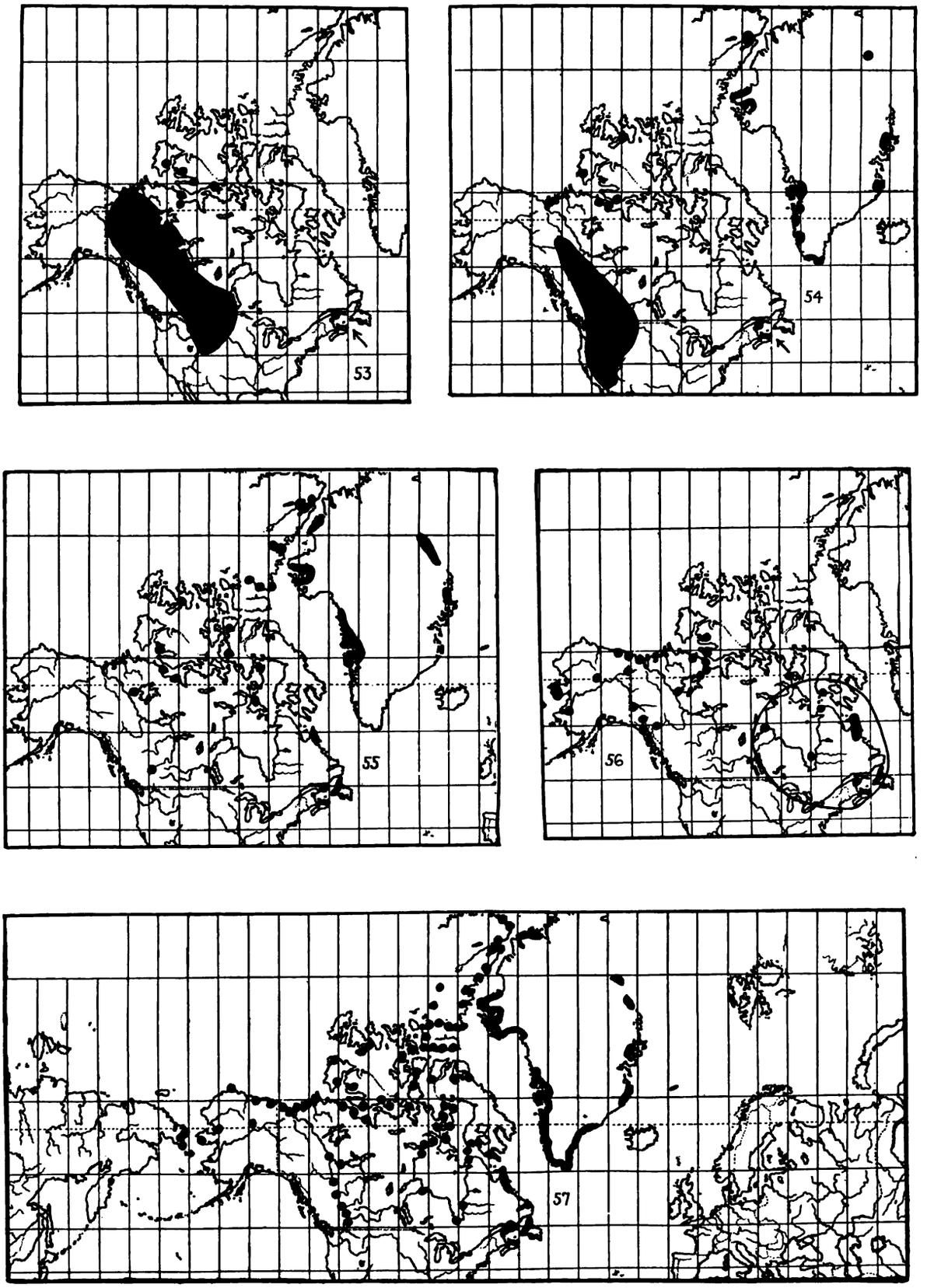
[1] J. H. Wilson, Glacial History of Nantucket and Cape Cod, 24 (1906).

[2] E. G. Vanatta, Proc. Acad. Nat. Sci. Phila. lxvi. 222 (1914).

[3] J. L. Le Conte, Proc. Am. Phil. Soc. xvii. 593 (1878).

[4] In working out the ranges of plants in arctic America, dependence has been largely placed on the detailed statements in the invaluable monograph of Dr. Herman G. Simmons, *A Survey of the Phytogeography of the Arctic Archipelago,* Lunds Universitets Årsskrift, n.f. Afd. 2. Bd. 9. Nr. 19 (1913).

[5] J. M. Macoun, Ott. Nat. xii. 164 (1898).

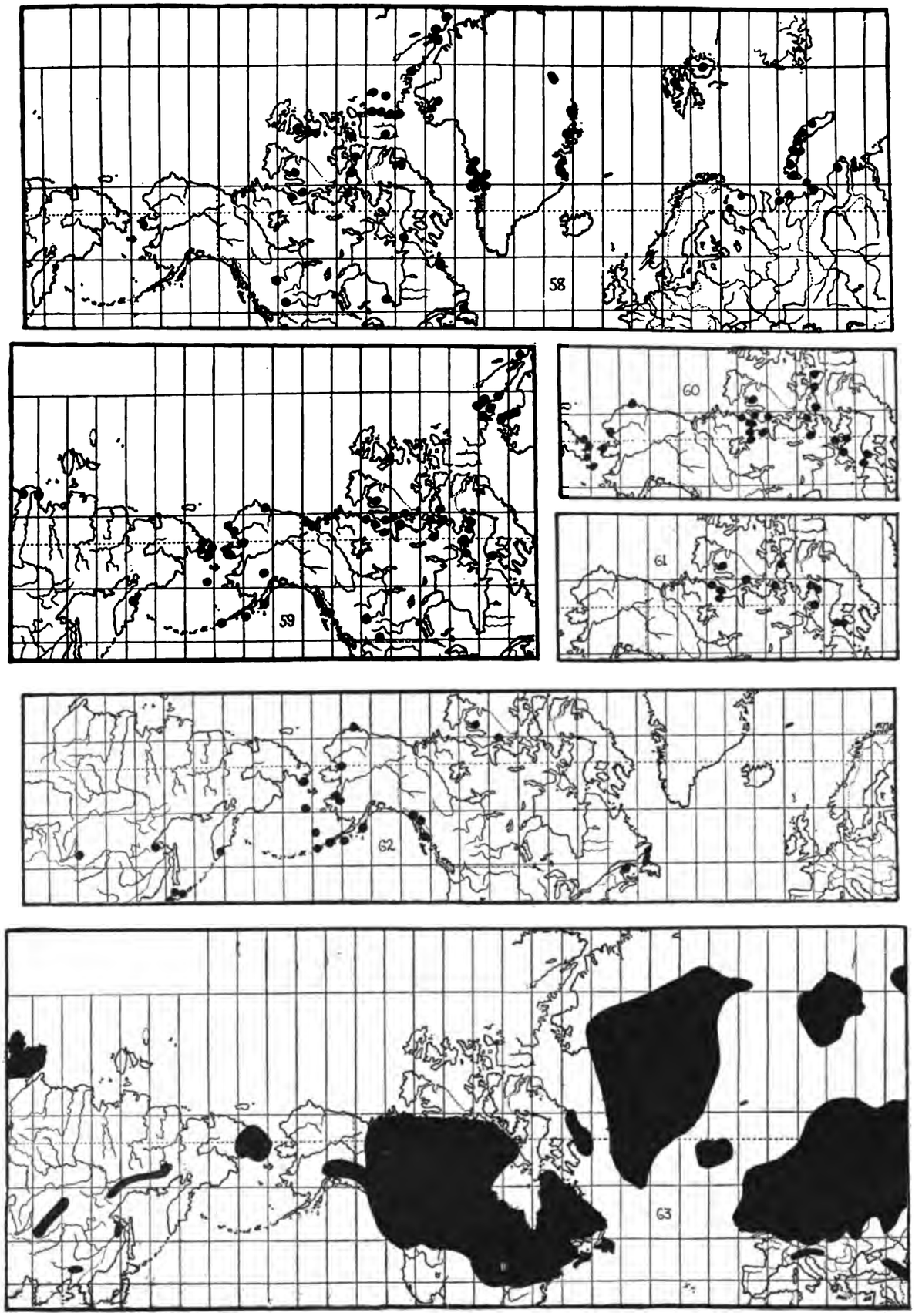


Ranges of (53) *Astragalus aboriginum;* (54) *Erigeron compositus;* (55) *Lesquerella arctica;* (56) *Salix Richardsoni* and, inclosed, *S. calcicola;* (57) *Dryas integrifolia.*

ward in Labrador, in northern and western Newfoundland, on the Mingan Islands, Anticosti and Gaspé. *Braya purpurascens* (map 58), an extreme arctic species, extending from the Arctic Archipelago to Greenland, Spitzbergen and Nova Zembla and the adjacent mainland, but otherwise very rare in Arctic Eurasia, has southern outliers in America quite comparable with those of *Lesquerella arctica* (map 55), *Salix Richardsoni* and *S. calcicola* (map 56) and *Dryas integrifolia* (map 57), on the mountains of Alberta, on the coast of James Bay, on the Torngat Mts. and in northwestern Newfoundland. *Pedicularis capitata* Adams (map 59) extends from the mouth of the Yenisei eastward in arctic Siberia and across the Arctic Archipelago to Ellesmereland and northwestern Greenland, south to Kamtchatka and southern Alaska, with isolated stations on the mountains of Alberta. Its discovery in western Newfoundland or in Gaspé or on the Torngat Mts. would make its map of distribution in North America quite similar to the others here discussed. These cases and the maps illustrating them are merely samples which are duplicated by other species; and the concentration of these plants upon the Arctic Archipelago inevitably calls to mind the species which are practically restricted to arctic America. For instance, *Chrysanthemum integrifolium* Richardson (map 60) is known only from Bering Straits around arctic Alaska and from east of the Mackenzie to North Somerset and the borders of Hudson Straits; and *Oxytropis arctobia* Bunge (map 61) is still more restricted, being unknown in Alaska and northeastern Siberia. Its discovery there would make the map of the range of *Oxytropis arctobia* practically identical with that of *Chrysanthemum integrifolium.*

As just stated, the cases here given are merely illustrative. In its main features the range of *Astragalus aboriginum* (map 53) is repeated by *Calamagrostis purpurascens* and the ranges of *Erigeron compositus* (map 54) and of *Lesquerella arctica* (map 55) by *Ranunculus Sabinei* R. Br., especially if *R. Allenii* proves to be conspecific with it (see p. 279). By elimination of the areas about the Gulf of St. Lawrence, the ranges of the Erigeron and the Lesquerella become very similar to those of *Saxifraga tricuspidata* Rottb. and by the dropping likewise of the Torngat area the ranges of *Potentilla rubricaulis* Lehm. and of *P. Vahliana* Lehm. are approximated. Essentially confined to northwestern arctic America, like *Salix Richardsoni* (map 56) are two other willows, *S. alascensis* (Anderss.) Coville and *S. glacialis* Anderss. Ranging, like *Braya purpurascens* (map 58), from the Arctic Archipelago (or from northeastern Siberia) eastward to Spitzbergen, Franz Joseph Land or Nova Zembla (or to them all) but absent or very local in continental arctic Eurasia are *Poa abbreviata* R. Br., *Arenaria Rossii* R. Br., *Potentilla pulchella* R. Br. and *P. emarginata* Pursh. Confined to arctic America and the Rocky Mts., like *Pedicularis capitata* (map 59) are such species as *Lupinus arcticus* Watson and *Phlox Richardsoni* Hook. Restricted like *Chrysanthemum integrifolium* (map 60) to arctic America and northeastern Siberia are *Carex membranopacta* Bailey (also on the Torngats), *Geum Rossii* (R. Br.) Serigne and *Oxytropis nigrescens* (Pall.) Fisch.; and restricted to the Arctic Archipelago and the adjacent mainland, like *Oxytropis arctobia* (map 61), are *Parrya arctica* R. Br., *Oxytropis Bellii* (Britton) Macoun and *O. arctica* R. Br. (probably also in western Newfoundland).

From these ranges of plants of the Arctic Archipelago it must be apparent that, in principle the ranges of *Oxytropis arctobia* (map 61) and *O. Bellii, O. arctica* and *Parrya arctica* belong with those of *Chrysanthemum integrifolium* (map 60), *Carex membranopacta, Geum Rossii* and *Oxytropis nigrescens;* that these merge directly into ranges like that of *Pedicularis capitata* (map 59), *Lupinus arcticus* and *Phlox Richardsoni* or like *Braya purpurascens* (map 58), and so progressively through the series until ranges like those of *Dryas integrifolia* (map 57) and of *Erigeron compositus* (map 54) are reached. It must be equally apparent that the discovery in the Arctic Archipelago of *Parnassia Kotzebuei* (map 3), *Salix brachycarpa* (map 5), *Danthonia intermedia* (map 6) and the other species with ranges indicated on maps 7–21, would at once place them in the categories with *Astragalus aboriginum* (map 53), *Erigeron compositus* (map 54), *Lesquerella arctica* (map 55),



Ranges of (58) *Braya purpurascens* (omitting 2 stations in arctic Siberia); (59) *Pedicularis capitata;* (60) *Chrysanthemum integrifolium;* (61) *Oxytropis arctobia;* (62) *Cerastium Fischerianum.* Map 63, Maximum of extensive Pleistocene glaciation in the Northern hemisphere (portion of Asia omitted).

Dryas integrifolia (map 57), and other species which radiate from the Arctic Archipelago; while the discovery in the latter region of *Hordeum boreale* (map 24), *Polygonum Fowleri* (map 25), *Senecio Pseudo-Arnica* (map 28) and *Senecio resedifolius* (map 29) would produce ranges quite comparable with that of *Cerastium Fischerianum* (map 62).

It thus seems clear that the geographic history of the plants which occur in western North America and on the unglaciated or but slightly glaciated areas about the Gulf of St. Lawrence or on the Torngat Mts. of Labrador (sometimes with intermediate stations at Churchill or elsewhere on the west side of Hudson Bay or in the region of the upper Great Lakes) is closely interlocked with the history of the Arctic Archipelago, and that the present disrupted ranges of many species of these regions cannot be properly interpreted without looking closely into the Pleistocene history of the Archipelago.

In North America, Pleistocene time was occupied by the development, gradual enlargement and eventual shrinking and disappearance of extensive glacial fields in regions which, chronologically, changed from a position in the West to one west of Hudson Bay, and finally to the Labrador Peninsula. In regard to these centers the summary by Tyrrell[1] is concise and clear: "There is probably no part of North America to which the student of glacial geology looks with greater interest than to the region lying north-west of Hudson Bay, for, during a part, or perhaps during the whole, of the glacial period, there here existed a great névé or 'gathering ground,' from which the ice flowed outward in all directions.

"The vast glacier thus formed has been called by the writer the Keewatin Glacier, from the Cree Indian word Ki-we'-tin, which means north, or north wind, and the name is considered appropriate, not only because the gathering ground lay partly within the district of Keewatin, but also because it was the most northern of three great centres of glaciation—the Cordilleran, the Keewatin and the Labradorean.

"Previous observations have shown that the Keewatin glacier was intermediate in time, as in position, between the first and last of those above-named. But, unlike them, the centre, from which its ice flowed outwards in all directions, was situated on a wide and moderately level plain, which is now from 400 to 800 feet only above sea-level and slopes seaward from higher land towards the south-west. Whether this plain was higher during any part of the glacial epoch than it is at present, has not as yet been determined, but no satisfactory evidence of such elevation has been found.

"At the close of the glacial period the land here stood several hundred feet below its present level, as is shown by the old beaches which rise one above another to heights of from 500 to 600 feet above sea-level on the maritime plain west of Hudson Bay."

The statement of A. P. Low in regard to the Keewatin and the Labrador sheets is likewise illuminating: "From a study of the different sets of glacial striae, Tyrrell concluded that the centre of glaciation was, in the early part of the glacial period, somewhere to the north and west of the head of Chesterfield inlet; that later, when the ice increased in thickness, the centre of dispersion moved to a position southwest of Baker lake; while as the glacier diminished the centre moved nearer the seashore, and the final stage was probably represented by the ice-cap breaking up into a number of distinct glaciers, each with local movement of its own.

"These conclusions of Tyrrell as to the southern movement of the centre of glaciation are borne out by the writer's observations of the striae along the shores of Roes Welcome, where as many as six sets of striae were found at Whale point, the usual number being three. The oldest set, found only at Whale point, showed that the ice movement was from the northwest. The

[1] J. B. Tyrrell, *Report on the Doobaunt, Kazan and Ferguson Rivers and the North-west Coast of Hudson Bay*, Geol. Surv. Can. Ann. Rep. n.s. ix. 175F–179F (1897).

next in age were from N. 50° E., or almost at right angles to the oldest; following in order of age come striae from N. 25° E., N., N. 30° W., and N. W. The last three sets are found in a number of places between Winchester inlet and Whale point; the others only at Whale point. The direction of the above sets of striae apparently shows that the earliest accumulation of ice in the region north of the western side of Hudson bay was somewhere to the northwest; this was followed by an abrupt change in the ice-movement, which was next from almost northeast, after which the centre of movement of the ice-cap gradually shifted, by way of north, to northwest. It would also appear that the centres of dispersion were much greater in area than the limits placed upon them by Tyrrell.

"This southern movement of the centre of dispersion of the ice is diametrically opposite to what occurred in the case of the ice-cap of Labrador, where the striae along the east side of Hudson bay show that the centre of ice-movement changed from a position near the central area of the peninsula, a short distance north of the southern watershed, to one some three hundred miles north, in the vicinity of the headwaters of the Koaksoak river.

"The glaciation of Labrador seems to have been later than that of the western side of Hudson bay, as the striae from the western glacier are almost obliterated by those from the east and northeast along the rivers south of James Bay." [1]

From these accounts it is clear that, long before the northern névé of the Labrador ice-sheet had disappeared the cordilleran region and the area eastward to Hudson Bay were free from glacial ice or at least quite open for plant-invasion. To what extent the Arctic Archipelago was invaded by the first advance of the Keewatin sheet we do not clearly know. Dawson[2] summarized the records of erratic boulders reported on the Archipelago, showing that, at the West, there might have been a movement northward from the continent; but Simmons, summarizing the publications on the Archipelago, states that the northern border of Pleistocene glaciation "seems to have coincided rather closely with the present continental shoreline, with the exception of Boothia Felix and the Melville Peninsula";[3] and Low, whose knowledge of the northern regions of America has been unexcelled, says, after personally examining the region from Hudson Bay and Strait to Smith Sound (between Ellesmereland and northwestern Greenland): "There is a marked difference in the evidence of the intensity of glacial action between the southern regions and the eastern and northern portions of the great area embraced in this report. On the shores and islands of Hudson bay and Hudson strait the crystalline rocks have been denuded of every trace of rotted surface material; they have been smoothed, polished and intensely striated, and their present condition is such that little or no change has taken place since the disappearance of the ice, which once covered them deeply, the striae being so fresh as to appear of the formation of yesterday. When the eastern mouth of Hudson strait is left, a change is soon seen in following the eastern side of Baffin island northward. The hills are less rounded, the talus lies on the slopes of the cliffs; about Cumberland gulf and Cyrus Field bay there is evidence of a universal ice-cap having been present, but the rounding, polishing and striation of the rocks are markedly less than to the south and westward. In these places it is exceedingly difficult to find striae upon the rock surfaces, and these when found show that the movement was local and from the highlands towards the open sea. In the northern part of Baffin island the hills become more serrated in outline, and many of the higher points appear to have never been subjected to glaciation, the glaciers having only filled the valleys; if an ice-cap existed the ice-movement to the coast was determined by the course of the local valleys, and there is no evidence of a movement not de-

[1] A. P. Low, *The Cruise of the Neptune*, 232, 233 (1906).
[2] G. M. Dawson, Geol. Surv. Can. Ann. Rep. n.s. ii. 57R (1887).
[3] Simmons, l.c. 153 (1913).

pending upon local conditions as is the case in the region about Hudson bay. At Erik harbour on the south side of the mouth of Ponds inlet, there is evidence that the glacier which now terminates at the head of the harbour once extended five miles farther sea-ward, and filled the valley to a height of 400 feet above the present level of the sea. Above that height the rocky walls of the harbour are not glaciated, and are covered by slopes of disintegrated rock. Passing north of Lancaster Sound to the south of North Devon, there is little evidence to show that the glaciation was ever much more severe than at present. At Cuming creek, a narrow fiord cut some twelve miles into the limestone cliffs, there is evidence that a glacier once covered its bottom and rose some two or three hundred feet above the present level of the sea; but it was purely local, and the limestone cliffs everywhere show that they have been long subjected to subaerial denudation, and that the broken rock covering their sides has never been displaced by ice.

"Very little time was given to the study of glaciation at Cape Sabine and the only evidence to show that it was more intense formerly was a low moraine in rear of Peary's house at Payer harbour. Schei, who devoted considerable attention to the glaciation of Ellesmere, is of the opinion that the ice covering never greatly exceeded its present limits, if it did so at all." [1]

Simmons states that "The only part of the Arctic Archipelago that shows signs of a considerable former glaciation is southern Baffin Land. . . . That the glaciation has here lasted up to a very late date, is generally supposed by geologist[s] who have studied the region in question. . . . The glaciation farther north, of small amount as it is, certainly has begun in a later period, when the elevation of the arctic area had come to an end, and a general subsidence had set in in its stead. . . . This subsidence allowed the formation of glaciers farther north, on both sides of Lancaster Sound, on the northeastern part of North Devon and along the eastern side of Ellesmereland. The glaciation of these regions never reached to form large ice sheets or continuous inlandices, only isolated glaciers in the valleys and thin ice caps over the summits of some mountains. In Ellesmereland at least this glaciation may be said to stand about its maximum even now, there being no traces of any considerable expansion of the present glaciers in former times . . . the glaciers of present time are entirely restricted to tracts where a strong current through a more or less narrow channel keeps the water open most part of the year, or perhaps all through the winter, and thus forms a local area of evaporation, feeding precipitation on adjacent high land." [2]

These general conditions, with the Arctic Archipelago and the peninsulas of Boothia Felix and Melville and most of Alaska unglaciated or only locally glaciated, are well brought out in the Carnegie Institution's map of Pleistocene glaciation which is published in Schuchert's *Historical Geology*[3] and here reproduced in part (with the Torngats, Gaspé and western Newfoundland indicated by the present writer as not profoundly glaciated) as map 63.

Simmons, accepting the pre-glacial elevation of the northern lands, points out that an uplift of only 600 feet above present levels, would convert the Arctic Archipelago into a continuous land confluent with the continent; and he explains the unglaciated condition of much of Alaska as due to the elevation of the Aleutian Islands, thus forming a continuous mountain chain which cut off the moisture-laden winds from the Pacific. At the same time the Arctic Archipelago was too dry for the formation of a glacial cap; and Simmons concludes, "That any plants, even the most hardy, could live there under such conditions, is hardly to be thought of, and thus the geological evidence leads to the same conclusion as the study of the flora, namely that plant-life has been extinct in the Arctic Archipelago during the climax of the iceage. The same holds good

[1] Low, *The Cruise of the Neptune*, 233, 234, (1906).
[2] Simmons, l.c. 155, 156 (1913).
[3] Schuchert, Hist. Geol. 945 (1915).

for the icefree areas in northwestern Greenland, where the same causes alone prevented the forming of an icesheet."[1] Consequently, he conceives that the plants of the Arctic Archipelago entirely abandoned that region and migrated southward during the Pleistocene:

"During earlier stages of glaciation, before the eastern (Labrador) icesheet and the western (Keewatin) closed together [which they probably did not do[2]], a southward way of escape must have existed, where the plants from the Hudson Bay area and the eastern islands of the Archipelago could retreat. A similar passage doubtless was to be found for a long time between the Keewatin inland ice and the Cordilleran icesheet; this may have been of a very great importance for the circumpolar species in reaching southward along the whole Cordilleran range, but even if it has certainly played a part in the reimmigration also, it has perhaps not had the importance that might easily be attributed to it in stocking the present arctic parts of the Continent and the islands with western american species, for, as is well known, there existed a wide area from the mouth of the Mackenzie to and beyond Bering Strait which was never glaciated, and where climatic conditions may have been such as to allow vegetation to live over the iceage."

"The land occupying the area north of the 'Aleutian Mountains,' as well as the present northern Alaska and its now submarine northern continuation, had doubtless had a very dry and cold climate, but so far south the summer must have been warm enough to melt away the snow of the plains, and it seems highly probable that plants have lived there during the whole glacial period under conditions rather nearly approaching those of the Arctic Archipelago at present. The importance of this unglaciated area as a refuge and centre of reimmigrations seems, however, only to have occurred to a single author, viz., C. C. Adams, who writes (Biota, p. 62): 'It also appears that some of the mountain biota of the Canadian Rockies were driven north into unglaciated Alaska as the ice spread from the Cordilleran centre of ice accumulation.' He also speaks of this region as a refuge of the Siberian types which had arrived when the land-connection with Asia was formed (p. 58), as well as of an earlier return of biota living [farther]south of the borderline of glaciation to the west than to the east."

Now, an inspection of maps of the present ranges, compiled from every authentic source[3] known to the writer, of the plants which form the distinctively North American element of the Arctic flora, as contrasted with the distinctively Siberian and European elements, brings out some important points. In the first place, these plants occupy in the North the regions which were nearly or quite unglaciated during Pleistocene time; or if, as in case of Greenland, they have made their way far outside the unglaciated region,[4] they are mostly present in the northwestern section which escaped Pleistocene glaciation. The map of the range of *Salix Richardsoni* (map 56) checked against the map of Pleistocene glaciation (map 63) shows this species to occupy almost exclusively a region which has not been glaciated; while its southeastern representative, *S. calcicola*, is on areas which escaped the Pleistocene glaciation or were among the first to be freed from it: western Baffin Land, the Torngat Mts., western Newfoundland and the Shickshock Mts. There are three known stations on Hudson Bay: Churchill, which is near the second névé of the Keewatin glaciers and therefore probably free from glacial ice long before the Labrador sheets had developed; the Twins in James Bay (portions of an old terminal moraine);[5] and a

[1] Simmons, l.c. 155 (1913).

[2] See pp. 326, 327.

[3] Simmons's statements of range; Ostenfeld's *Flora Arctica;* Hooker's *Flora Boreali-Americana;* Ledebour's *Flora Rossica;* Macoun's *Catalogue of Canadian Plants;* Report of the Canadian Arctic Expedition, 1913–18; Low's *Cruise of the Neptune;* Contributions from the Herbarium of the Geological Survey of Canada; Kjellman's report in *Die Wissenschaftlichen Ergebnisse der Vega-Expedition;* Porsild's mss. maps of Greenland ranges; and the collections in the Gray Herbarium.

[4] The degree to which the coastal rim of Greenland was glaciated is not settled.

[5] Low, Geol. Surv. Can. Ann. Rep. n.s. iii. 623 (1888).

third station near Cape Walstenholme where the force of glaciation was not sufficient to remove the rotten rock, for of this region Low writes: "The rotten state of the cliffs would at first lead to the belief that they had been unglaciated, but an examination of the undecayed surfaces near the water and on the hills above show that such was not the case, the stream of the glacier having striated the summits of the highest points."[1] *S. Richardsoni*, then, is essentially confined to a region which escaped extreme glaciation in the Pleistocene and its ally, *S. calcicola*, chiefly, if not entirely, to equally unglaciated areas or to regions which were early free from Pleistocene ice or not completely denuded by it.

Lesquerella arctica (map 55), similarly, occupies the unglaciated region of the North, quite to Ellesmereland and northwestern Greenland; southward with localized stations on arid mountains from Great Bear Lake to Alberta, a region very early freed from continental ice, and on the Torngats, in western Newfoundland and on the problematical Anticosti Island; *i.e.*, like *Salix Richardsoni* and *S. calcicola*, it is chiefly if not absolutely upon unglaciated areas or those which were earliest freed from the continental ice, and the case of *Lesquerella arctica* is practically duplicated by that of *Ranunculus Sabinei* and its close ally, *R. Allenii*.

Erigeron compositus (map 54) and *Astragalus aboriginum* (map 53) show the same principle, with their North American areas in the unglaciated Northwest, on the unglaciated cliffs of northern Gaspé and broad ranges in the cordilleran region. And so on through a long list, *Calamagrostis purpurascens*, *Braya purpurascens* (map 58), *Pedicularis capitata* (map 59), *Lupinus arcticus*, *Phlox Richardsoni*, *Cerastium Fischerianum* (map 62), etc.; while such plants as *Oxytropis arctobia* (map 60), *O. Bellii*, *O. arctica*, *Parrya arctica*, *Chrysanthemum integrifolium* (map 61), *Carex membranopacta*, *Geum Rossii* and *Oxytropis nigrescens* are unknown southward but are quite restricted to unglaciated arctic America or in some cases have barely crossed the formerly dry Bering Strait.

If, as Simmons believes, these plants could not stand the climate of the Arctic Archipelago during the time that glacial fields lay to the south of that region, and if they then went far to the south or into unglaciated Alaska, to return northward at the close of the Pleistocene, it certainly seems an amazing situation that during such a hypothetical reoccupation of the North, these plants in the main should have occupied only the unglaciated or but slightly glaciated areas between Nova Scotia and southern Newfoundland at the south and Ellesmereland at the North. Only very exceptionally do they occur in the heavily glaciated areas of Newfoundland, Labrador and Baffin Land; yet it is certain that such xerophytes of the rock barrens and dry talus as *Salix calcicola*, *Lesquerella arctica*, *Braya purpurascens*, *Saxifraga tricuspidata*, *Dryas integrifolia*, *Astragalus aboriginum*, *Erigeron compositus*, *Artemisia borealis* and *Crepis nana* could find crevices for their roots in glaciated rocks and debris quite as satisfactory as those they occupy in the unglaciated spots.

Such evidence as this leads the author to the belief that the plants which now occur on the Arctic Archipelago lived there essentially undisturbed during Pleistocene glaciation; but that many of them, upon the diminution of the Cordilleran ice-fields, readily pushed south in western North America and upon the dwindling of the first, then the second and finally the third (and southernmost) névé of the Keewatin sheets they could and did readily advance along the west coast of Hudson Bay, where they show no disinclination to occupy glaciated ground. During the long period when glaciation was at its maximum west of Hudson Bay but not yet developed on the Labrador Peninsula, the plants of the Arctic Archipelago (then uplifted and continuous with the continent) apparently followed across Labrador to Gaspé and Newfoundland; but with the development of the comparatively recent Labrador and Newfoundland ice-sheets these

[1] Low, Geol. Surv. Can. Ann. Rep. n.s. xiii. 19D (1902).

plants were eliminated from the areas where glaciation was extreme but have persisted in favored spots which either escaped denudation by the continental and Newfoundland ice-sheets or were only slightly affected by them.

That many species outlived the Pleistocene in the unglaciated regions of Alaska and northern Siberia there can be no question, but until *Oxytropis arctobia* (map 61), *Lesquerella arctica* (map 55), *Erigeron compositus* (map 54), *Astragalus aboriginum* (map 53) and the other species with similar ranges are found in Alaska it would seem more reasonable to suppose that they had survived on the Arctic Archipelago than that they have migrated from and abandoned Alaska.

As further evidence that these plants, which are endemic to or which radiate from the Arctic Archipelago, there outlived the Pleistocene we have certain other important facts. The total area in North America covered by Pleistocene ice is generally stated to be 4,000,000 square miles. This includes 1st, the ancient Cordilleran sheet; 2d, the first Keewatin sheet; 3d, the second Keewatin sheet; 4th, the third and southernmost Keewatin sheet; 5th, the first Labradorean sheet originating near the Laurentian upland; 6th, the second Labradorean sheet radiating from near central Labrador; 7th, the last Labrador sheet, radiating from the northern part of the peninsula; and to these might be added the glacial field of southern Baffin Land which Simmons, following Barton and Tarr, believes to have originated contemporaneously with the northern Labrador névé and like it to have lasted until very recent time (only a few thousand years ago). The total area of any one of these eight ice-fields is naturally only a fraction of the whole area covered by them all. But in Greenland the Pleistocene ice is supposed to have covered all but the dry northwestern region and possibly some spots southward along the coast; but, except for the coastal rim, the greater part of Greenland is still under a continuous ice-cap and in a glacial period. Now, the total area of Greenland is 826,000 square miles, more than the area of the Labrador Peninsula or probably of any region which was occupied at one time by the Cordilleran or the Keewatin ice-sheets. As already pointed out (p. 320), 58½% of all the species known from Greenland occur also near sea-level south of the St. Lawrence; 24% of them in southern New England and 6% in the neighborhood of Washington, D. C. It has also been pointed out (p. 320) that *18% of the plants of Greenland reach their northern limits in eastern America* (excluding Greenland) *at or near the Straits of Belle Isle* (*latitudes 48°–54°*). Very similarly, of the 204 species recognized by Simmons as occurring on the Arctic Archipelago, 88 or 44% of the species of the Archipelago occur also near sea-level south of the St. Lawrence and 18 species (9%) reach southern New England. When the flora of the northernmost land of the Arctic Archipelago, Ellesmereland, (lat. 78° 8′–83° 8′ N.) is examined, we find similar results. Of the 115 species of vascular plants known[1] in Ellesmereland 51 (44% of the Ellesmereland flora) are found at sea-level south of the St. Lawrence, and 6 species (5%) reach southern New England. Surely, if more than half the plants which are now outliving a glacial period in Greenland thrive at sea-level in latitudes 44°–51° in eastern North America and if 44% of the plants of Ellesmereland are equally at home in these latitudes, it is wholly reasonable to believe that these and more boreal species could have lived on the Arctic Archipelago while lands to the south were occupied successively by ice-sheets not larger than that which now covers Greenland.

The mingling of arctic and temperate or even subtropical types in eastern America has more than once been emphasized. In a discussion of Nova Scotia the present author has said: "In a region where the Louisianian *Lycopodium inundatum*, var. *Bigelovii* (*L. adpressum*) and the Louisianian and Carolinian *Utricularia subulata* creep among the bases of *Carex Goodenowii* (Greenland and arctic America, south to Nova Scotia and eastern Massachusetts) or of *Juncus filiformis* (Greenland to Massachusetts and the mountains of Pennsylvania); where the Louisi-

[1] See Simmons, *The Vascular Plants in the Flora of Ellesmereland* (1906).

anian and Carolinian *Eleocharis tuberculosa* vies with *Carex oligosperma* (Labrador to Great Bear Lake, etc.) for the possession of the edge of a savannah; where the dominant undergrowth in the spruce, fir, and larch swamps includes the Louisianian and Carolinian Inkberry, and such a distinctly southern plant as *Solidago Elliottii;* where the Inkberry makes tall thickets with *Ledum groenlandicum* or pushes its branches through the carpet of arctic Crowberry, *Empetrum nigrum*, or the arctic Cloudberry or Bakeapple (*Rubus Chamaemorus*);—in a region where these comminglings of Arctic or Hudsonian with Louisianian or Carolinian species are met at every turn, one is certainly perplexed to make Merriam's zones fit the facts. My friends in the more arid and elevated regions of the West seem to find them of practical value, and in our own upland country they are useful concepts if their use is constantly tempered by that rarest of virtues, sound judgment; but in our humid and lowland regions of the Northeast they are so tangled that it is doubtful whether a commensurate return can be gained from the effort to untangle them. Incidentally, Merriam makes the moose an indicator of the Hudsonian. How lost this great animal must feel in Yarmouth County as it breaks its way through the thickets of Inkberry and tangles of Green Briar to the lake-margins, there to browse on the Louisianian and Carolinian *Brasenia, Nymphoides* or *Solidago tenuifolia*!"[1]

In western Newfoundland, similarly, it is quite possible to stand on rock-barrens carpeted with the arctic xerophytes, *Festuca vivipara, Carex rupestris, C. glacialis* (*C. pedata*), *Salix reticulata, S. cordifolia* (*S. glauca* of eastern America), *Silene acaulis* var. *exscapa, Lesquerella arctica, Saxifraga oppositifolia, Dryas integrifolia, Rhododendron lapponicum, Arctostaphylos alpina, Diapensia lapponica* or *Statice labradorica* and, by stepping a few feet into the adjacent bogs, meadows, brooksides or thickets, to find one's self in the midst of such plants of temperate or even austral range as *Thelypteris noveboracensis, Schizaea pusilla, Glyceria nervata, Eriophorum virginicum, Carex leptalea, C. folliculata, Juncus canadensis, Iris versicolor, Habenaria clavellata, H. blephariglottis, Ranunculus abortivus, Sarracenia purpurea, Drosera longifolia* (*intermedia*), *Acer rubrum, Impatiens biflora, Hypericum virginicum, Aralia nudicaulis, Heracleum lanatum, Cicuta bulbifera, Epigaea repens, Gaylussacia baccata, Bartonia paniculata* (var. *iodandra*), *Senecio aureus, Cirsium muticum*, etc., etc. This intimate commingling of southern species (even Carolinian in some instances) with plants which characterize the Arctic seems, in Newfoundland at least, to be due to the differences of habitat which the two series affect. The arctic types prevail on the dry rocks or on wind-swept crests, *i.e.* they are primarily controlled in their southern distribution by aridity and bleakness, the climatic features most obviously distinguishing the unglaciated Arctic areas. In describing the climate of the Arctic Archipelago, which, as we have seen, is essentially unglaciated, Simmons says, "The most prominent and important factor I take its extreme dryness to be,"[2] and this is certainly the most prominent factor in the isolated southern habitats of the arctic plants. But in Newfoundland, bogs, wet thickets, brooksides and meadows are characterized by southern types and it is in such favorable habitats that all notable extensions of southern species occur; and even as far south as Setchell's marine "North Subtropical Zone" arctic types can persist, provided that they find bleak and arid spots. In his discussion of the distribution of marine algae in eastern America, Setchell concludes that, "the district between Chatham, Massachusetts on the east and New London and Montauk Point on the west, belongs to the North Subtropical Zone so far as the inland or sheltered waters are concerned and more or less normally to the North Temperate Zone, so far as the outer points . . . are concerned."[3] In general the same classification holds for the land-plants, Cape Cod and Long

[1] Fernald, Rhodora, xxiii. 169 (1921).

[2] Simmons, l.c. 30. Stefansson and earlier explorers also emphasize the aridity of Arctic lands.

[3] Setchell, Rhodora, xxiv. 9 (1922).

Island being locally famous for the large percentage of austral species which there reach their northern limits. Yet on the wind-swept sand-hills from Chatham to Provincetown occur such arctic types as *Potentilla tridentata* and *Elymus arenarius* var. *villosus*;[1] while wind-swept Montauk Point has a small (possibly relic-) colony of the arctic *Empetrum nigrum*.[2]

In a recent publication upon the relationships of the alpine flora of the Rocky Mts., Dr. Theodor Holm, following the generally accepted hypothesis, that the plants of Arctic America migrated south along the Rocky Mts. and at the close of Pleistocene glaciation *returned* to the Arctic, says:

"With respect to North America, the Rocky Mountains have no doubt contributed to the Arctic flora, inasmuch as they are harboring a number of glacial species.

"The power of certain Arctic species to adapt themselves so as to thrive and persist on the higher mountains farther south, as well as the Alpine species being capable of migrating north together with the Arctic and to locate there, are the factors that govern the remarkable distribution of Alpine, Arctic, and circumpolar species; and most remarkable is the fact that only a few of these glacial plants now inhabiting the Alpine regions have changed their aspect and structure so as to exhibit a variation from their Arctic prototypes.

"Thus in defining the Arctic element of the Alpine flora of Colorado it seems natural to suppose that all the circumpolar species originated in the polar regions, while some of those that are merely Arctic-Alpine may have developed in the south, but accompanied their Arctic brethren on their return to the north. The latter explanation is also applicable to such species as are not Alpine, but which, nevertheless, are known to occur in the northern regions. I think especially of *Chamaenerium angustifolium, Linnaea borealis, Draba aurea, Arabis Holboellii, Pyrola secunda, Carex vulgaris*, and *Luzula parviflora*, all of which are known from subarctic Greenland." [3]

In view, however, of the overwhelming paleontological evidence of the former Arctic occurrence of many genera, such as *Taxodium, Carya, Corylus, Carpinus, Platanus, Magnolia, Rhus, Ilex, Acer, Fraxinus, Tilia, Nyssa* and *Diospyros*, and their later migration or restriction to more southern areas where they have sometimes multiplied their species, sometimes reduced them; and in view of the large temperate American element (p. 320) in the flora of southern Greenland, which must have received its American plants by way of Ellesmereland, it is worth while to consider whether such prevailingly American or American and Asiatic genera as *Astragalus, Oxytropis, Hedysarum, Phlox, Pedicularis, Castilleja, Erigeron, Artemisia* and *Arnica* may not likewise have radiated from the Arctic Archipelago or Alaska or arctic Siberia (or from all of these once confluent areas) and, pushing south into more hospitable and highly diversified regions, have there differentiated into a wealth of endemic species.

Similarly, in view of the apparently high-arctic route of migration into Greenland of a large flora now otherwise known only in temperate North America, it seems quite reasonable to picture the species or genera which are not now known in the Arctic but which have their areas of distribution widely segregated,—on the Pacific slope or the Cordillera and in the unglaciated regions about the Gulf of St. Lawrence, with occasional intermediate spots on the west shore of Hudson Bay or on the upper Great Lakes—as likewise radiating from the Arctic Archipelago and thence migrating to their present more southerly areas.

A distinction is apparently to be made between the plants of exclusively or essentially American and Asiatic arctic-alpine range and many of the circumpolar arctic-alpine species which are widely dispersed over western and central Europe. The former (with some species of arctic-

[1] J. Murdoch, Jr., Rhodora, xv. 218 (1913).

[2] Taylor & Hill, Torreya, xxiv. 87 (1924).

[3] Holm, *The Vegetation of the Alpine Region of the Rocky Mountains in Colorado.* Nat. Acad. Sci. Mem. xix. No. 3: 16, 17 (1923).

alpine Norway or Lapland and arctic Russia) seem, in many cases at least to be remnants of a flora of greater antiquity than the more generally circumpolar types. At least, the essentially American and Asiatic types seem to have made their migration to the region about the Gulf of St. Lawrence before the Labrador ice-sheet had developed and they are there chiefly confined to the areas which were undisturbed or only slightly disturbed by the late Pleistocene glaciation,—such plants as *Woodsia scopulina* (map 9), *Sparganium hyperboreum*, *Festuca scabrella* (map 7), *Poa eminens*, *Calamagrostis purpurascens*, *Agrostis melaleuca*, *Carex pratensis*, *Salix vestita* (map 15), *arctophila*, *cordifolia* and *myrtillifolia*, *Polygonum Fowleri* (map 25), *Arenaria dawsonensis*, *cylindrocarpa* (map 13), and *macrophylla* (map 31), *Stellaria longipes*, *Cerastium Beeringianum* and *Fischerianum* (map 62), *Ranunculus hyperboreus*, *Lesquerella arctica* (map 55), *Braya purpurascens* (map 58) and *humilis*, *Barbarea orthoceras*, *Draba nivalis*, *Parnassia Kotzebuei* (map 3), *Potentilla fragiformis*, *Dryas Drummondii* (p. 286) and *integrifolia* (map 57), *Astragalus aboriginum* (map 53), *Oxytropis viscida* (p. 300), *Hedysarum Mackenzii*, *Epilobium latifolium* (map 64) and *wyomingense*, *Vaccinium ovalifolium* (map 10), *Gentiana propinqua*, *Lomatogonium rotatum* (map 67), *Valeriana sylvatica*, *Campanula uniflora*, *Erigeron compositus* (map 54), *Artemisia borealis* (map 66), *Senecio resedifolius* (map 29), *pauciflorus* and *Pseudo-Arnica* (map 28) and many others of Tables II, III and IV. The comparative antiquity of these chiefly Siberian-American arctic-alpine types (with a few others like *Gentiana detonsa*, *Antennaria alpina*, *Petasites frigida*, *Arnica alpina* and *Tanacetum bipinnatum* which have reached arctic Russia or arctic-alpine Scandinvaia) is further attested by the fact that it is from the plants of this range that most of the endemics centering as excessively rare and already seemingly relic-species on the unglaciated areas about the Gulf of St. Lawrence seem to have been derived,—*Carex misandroides* (map 16), with 3 known stations, representing some Arctic species and two species of Alberta; *Salix laurentiana* (map 23), with 2 areas, representing *S. Hookeriana* and *S. amplifolia* of the Pacific coast; *S. latiuscula*, with a single station, now lost, representing *S. Barclayi* of the Alaskan region; *S. hebecarpa*, with a single station, representing *S. fuscescens* of Alaska and Siberia; *Arenaria marcescens* (map 11), with 2 areas, representing *A. arctica* of Alaska and Siberia and *A. obtusiloba* of the Rocky Mts.; *Ranunculus Allenii*, with 3 stations, representing the Arctic American and cordilleran *R. Sabinei*; *Saxifraga gaspensis*, with a single area, representative of the arctic *S. nivalis* and of a large series of cordilleran species; *Conioselinum pumilum*, with 2 areas, representative of the Siberian *C. kamtschaticum*; *Gentiana nesophila*, with 3 areas, representative of the Siberian and Norwegian *G. detonsa* and of several cordilleran species; *Solidago chlorolepis*, with a single station, representative of *S. decumbens* and other cordilleran species; *Antennaria cana*, *vexillifera*, *straminea*, and several others, each with from 1 to 3 known stations, representative of the arctic *A. alpina* and of a dozen or more species found from Alaska to California and New Mexico; *Arnica pulchella* and *Griscomi*, each known from a single alpine area, representative of the arctic *A. alpina* and of a large series of cordilleran species; *Agoseris gaspensis* (map 12), with a single subalpine area, a representative of a large cordilleran genus; and so on with most of the remaining 62 endemic species of Table IV. Quite similarly, but naturally to a much greater degree on account of the vast area of highly diversified country which has been clear of continental ice since the dwindling of the early Pleistocene cordilleran ice-field, the cordilleran region has its localized endemic species related to and by ultra-conservatives not always differentiated from the same arctic types as those which are represented in Gaspé and western Newfoundland.

When, however, we examine the ranges of such circumpolar species as *Asplenium viride*, *Lycopodium Selago*, *Sparganium angustifolium*, *Phleum alpinum*, *Calamagrostis neglecta*, *Festuca supina*, *Eriophorum angustifolium*, *Carex concolor*, *C. capillaris*, *Juncus trifidus* and *J. stygius*, *Luzula spicata*, *Listera cordata*, *Polygonum viviparum*, *Oxyria digyna*, *Subularia aquatica*, *Sedum*

roseum, *Saxifraga Aizoon*, *S. aizoides*, *S. oppositifolia*, *Sibbaldia procumbens*, *Rubus Chamaemorus*, *Empetrum nigrum*, *Viola palustris*, *Epilobium alpinum*, *Loiseleuria procumbens*, *Phyllodoce caerulea*, *Arctostaphylos alpina*, *Vaccinium uliginosum*, *V. Vitis-Idaea* and *Pinguicula vulgaris*, we find that they occur in arctic and subarctic Europe, Asia and America and that in both Europe and eastern North America their southern outliers are in the regions invaded by the latest continental ice-sheets (in America the Labradorean or Wisconsin ice-sheet, in Europe the last Baltic sheet) and in several cases living or late Pleistocene fossil colonies are known near or south of the terminal moraines (in eastern America *Lycopodium Selago* and *Juncus trifidus* on the Carolina mountains, *Listera cordata* in the Chamaecyparis swamps at the southern margin of the terminal moraine which forms the "back-bone" of Cape Cod, *Sedum roseum* in eastern Pennsylvania, *Rubus Chamaemorus* and *Empetrum nigrum* at Montauk Point at the tip of Long Island and *Loiseleuria procumbens* along the Bay of Fundy). That these species came from arctic or subarctic regions with or in front of the last continental glaciers of eastern America and the comparatively recent continental glaciers of Europe there can be no question; and after the receding of the Wisconsin ice from New England and the local ice from Newfoundland they have taken possession of *glaciated*, as well as unglaciated, regions north of the terminal moraines. These and many others with similar history and distribution are the plants of the glaciated mountains of New England and of barrens and rock-crests in the glaciated central and eastern half of Newfoundland and on the profoundly glaciated Labrador Peninsula. Yet, as already stated, they are quite as abundant on the unglaciated areas of the Shickshock Mts. or the Long Range as are the apparently more ancient arctic types which are there restricted to the unglaciated spots. Furthermore, although pushed far south of the Arctic by the cold of the Wisconsin and the European glaciations and now prospering fifteen or twenty degrees or even farther from the Arctic Circle, these plants have not set off local endemics. *Lycopodium Selago* has minor but confluent ecological variations; *Carex capillaris* in favorable conditions becomes var. *elongata* Olney, merely an overgrown state of the arctic-alpine dwarf extreme; *Juncus trifidus* in the southern half of its range, both in Europe and eastern America, passes to the leafy var. *monanthus* (Jacq.) Bluff & Fingerhuth; *J. stygius* of America is treated by Buchenau as a geographic variety on account of slight difference in size; *Vaccinium uliginosum* in arctic-alpine regions of America is separable as var. *alpinum* Bigel., with smaller leaves and shorter pedicels and an inconstant character in the anthers, and *Vaccinium Vitis-Idaea* in arctic regions and its entire American range is var. *minus* Lodd., characterized merely by dwarfing of all its parts. But these variations, which may possibly be interpreted as incipient species, have not yet progressed to the point of sharp specific differentiation nor do they show the local and obvious relic-endemism so apparent in the plants of the unglaciated spots already discussed. In western America where the ancient arctic types have given rise to a large endemic flora scattered along the Cordillera, the younger group has representatives which perhaps followed south along the north-and-south ranges which begin practically at the Arctic Circle. Of the 31 species above listed as representative 18 are found on the Cordillera in the United States and 7 others occur locally on the mountains of Alberta; but in the Cordillera as in the East, they have as yet set off no endemic representatives, unless the purple-flowered cordilleran species of *Sedum* § *Rhodiola* be regarded as derived from the quite different yellow-flowered *S. roseum*.

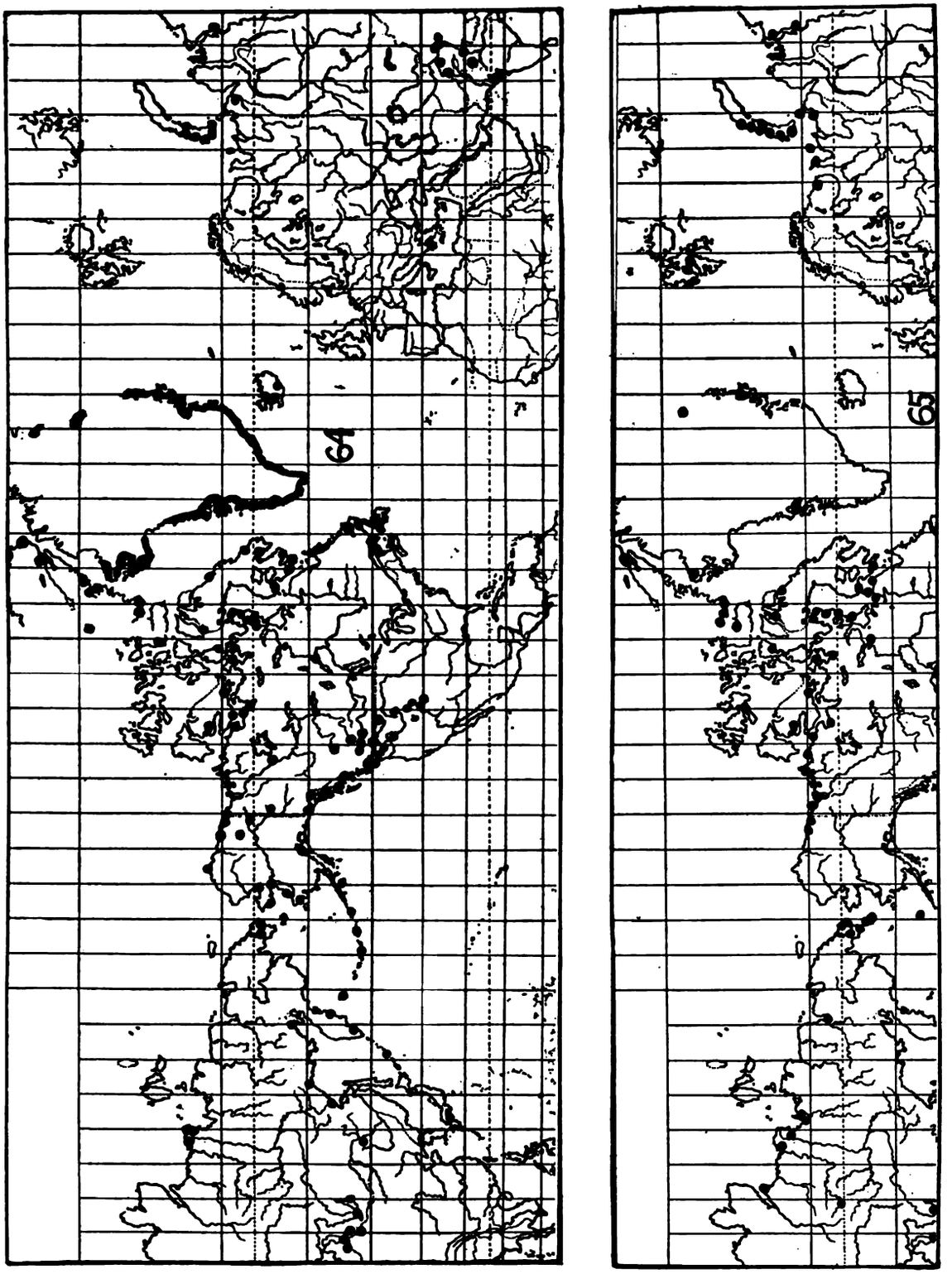
The more ancient arctic or cordilleran types and their endemic offshoots, which in eastern America are so closely confined to the unglaciated or but locally glaciated areas, are there the most local of plants. It is perfectly possible for the keenest field-botanist to start from the northern sea-cliffs of Gaspé and to cross the Shickshock Mts. without once seeing many of the most interesting plants, for we thus far know them from only one or two excessively localized spots each; such conspicuous but rare plants of Gaspé as *Woodsia scopulina* (map 9), *Polystichum*

mohrioides, var. *scopulinum* (map 4), *Festuca scabrella* (map 7), *Carex Macloviana*, *C. misandroides* (map 16), *Salix calcicola* (map 56), *S. chlorolepis*, *S. herbecarpa*, *Ranunculus Allenii*, *Saxifraga gaspensis*, *Potentilla fragiformis*, *Astragalus aboriginum* (map 53), *Pedicularis flammea*, *Campanula uniflora*, *Erigeron compositus* (map 54), *Antennaria vexillifera*, *A. Peasei*, *Arnica Griscomi*, *Senecio resedifolius* (map 29) or *Agoseris gaspensis* (map 12). But it would be quite impossible to cross the higher Shickshocks, Table-top, Albert and Logan for instance, without encountering extensive and dominating colonies of *Lycopodium Selago*, *Phleum alpinum*, *Eriophorum angustifolium*, *Carex concolor*, *Juncus trifidus*, *Luzula spicata*, *Polygonum viviparum*, *Saxifraga Aizoon Sibbaldia procumbens*, *Rubus Chamaemorus*, *Empetrum nigrum*, *Viola palustris*, *Loiseleuria procumbens*, *Phyllodoce caerulea*, *Arctostaphylos alpina*, *Vaccinium uliginosum* and *V. Vitis-Idaea*. In fact, so excessively abundant are most of these plants that the botanist quickly comes to look upon them as the alpine "weeds," aggressive, dominating and everywhere inclined to crowd and choke out the small colonies of the vastly interesting but obviously more ancient and unaggressive species.

From these considerations it seems probable, then, that the more ancient arctic flora, which is mostly unrepresented in central Europe and only slightly and locally so in extreme northern Europe, but which centers chiefly upon unglaciated arctic Siberia and the unglaciated Arctic Archipelago, spread southward in America during the early Pleistocene and in the long period which has elapsed it has given rise to many species, which in eastern America are now extremely localized relic-endemics occurring at one or few small stations primarily in the areas which have been least disturbed by later glaciation and showing practically no tendency to spread into adjacent and recently glaciated areas where conditions are apparently favorable. Such facts lead to the conclusion that these endemics are already so old as now to be nearly extinct. On the other hand, the younger arctic flora which made its way south, in eastern America and in Europe at least, coincidentally with the advance of the comparatively recent Labradorean or Wisconsin and the later Baltic ice-sheets, has not yet had time to set off local species, though in some cases it shows minor variations which are not yet sharply differentiated; and, far from being the rarest and most retiring of relics on our mountains, these young plants, like the young of the human species, are aggressive, dominating and from mere youthful vigor inclined to crowd out the survivors of a more ancient cycle whose territory they have only recently invaded.

RELATION OF AMERICAN AND EUROPEAN ARCTIC FLORAS

As already noted, some species of broad range in northern North America and Siberia are known in Europe only in the extreme North and have not there spread southward to the latitudes reached by many of them or by their highly localized endemic offshoots in North America and Asia. In Europe proper they are confined to Nova Zembla or the adjacent arctic mainland or neighboring small islands or to the Kola Peninsula or in some cases to arctic-alpine Norway and Sweden. They may also occur on Spitzbergen or Iceland and Jan Mayen Land; but the striking feature of their distribution is that, in Europe they rarely extend south of latitude 60° N., while in Asia or in North America they commonly come down to latitudes 50°–40°, often to 40°–35° (in western North America) and in exceptional cases, like *Epilobium latifolium* (map 64) in the Himalaya to 28°. Although the European stations for some of these American-Siberian types are very few, the total number of such species in arctic Europe or in alpine Scandinavia is large,—more than 70 species. Were it not for their very limited occurrence in northernmost Europe the large number of these plants in Tables II and III would naturally find places in Table IV. Several like *Eutrema Edwardsii* (map 65) are quite circumpolar and essentially arctic. Here belong also

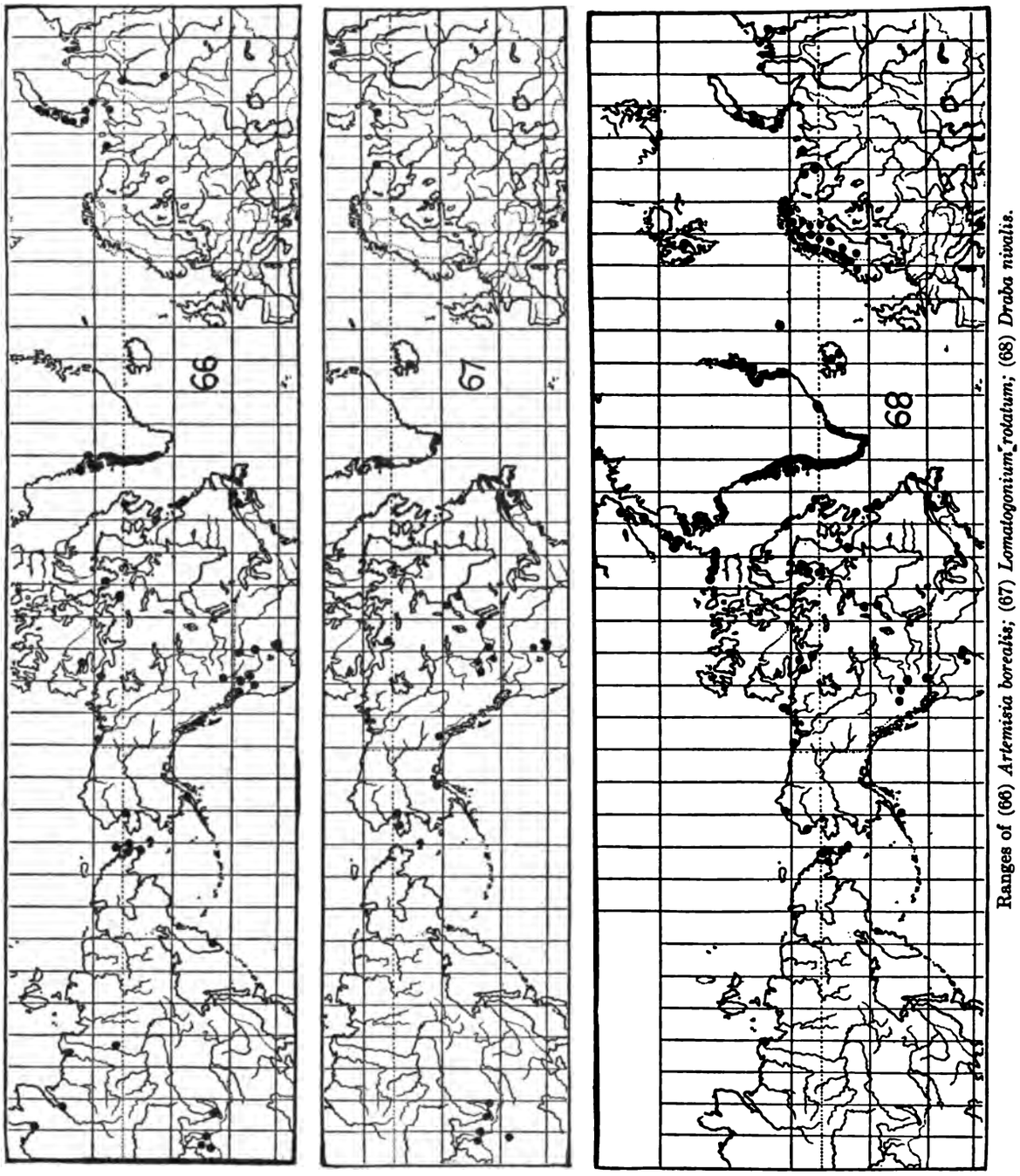


Ranges of (64) *Epilobium latifolium;* (65) *Eutrema Edwardsii.*

Hierochloe pauciflora, Arctagrostis latifolia, Colpodium fulvum, Dupontia Fisheri, Carex ursina, and numerous others.

Some, like *Braya purpurascens* (map 58) are primarily arctic American and arctic European, but in America they may have colonies isolated southward about the Gulf of St. Lawrence or on the Rocky Mts., such species as *Arenaria Rossii, Potentilla pulchella* and *P. emarginata.* Others like *Artemisia borealis* (map 66) are circumpolar but have concentrated southern areas on the Altai and Baikal Mountains, on the American Cordillera and on the Shickshocks and Long Range; while *Lomatogonium* (*Pleurogyne*) *rotatum* (map 67) is a species with its southern centers similarly in the Altai-Baikal region, the Rocky Mts. and the region of the Gulf of St. Lawrence, but it is apparently unknown in arctic Asia and barely present in arctic America. *Draba nivalis* (map 68) and *Carex glacialis* (*C. pedata* Wahlenb., not L.) (map 69) are both circumpolar and in northern Europe they have followed south on the Scandinavian mountains, but they are both apparently wanting in the Altai, and the latter, a dominant turf-plant of limestone ledges and gravel in western Newfoundland, has not been found southward in the Rocky Mts. Similar in range to one or another of these illustrations are the remaining more than three score of species including such thoroughly distinctive plants as *Sparganium hyperboreum* (south in America to Newfoundland, Cape Breton and Idaho); *Eriophorum Chamissonis* (to Nova Scotia and Wyoming), *E. opacum* (to western Newfoundland and southern Alberta); *Carex nardina* (to Gaspé and Colorado); *C. Macloviana* (to Gaspé and Oregon thence southward and in the mountains represented by very many endemic American species); *C. subspathacea* (to Gaspé and southern Alaska); *Salix vestita* (to western Newfoundland, Gaspé and Oregon, see map 15, with an endemic ally on the Long Range of Newfoundland); *S. anglorum* (to western Newfoundland, Gaspé and southern Alberta), *Stellaria longipes* (to western Newfoundland, eastern Quebec, the Great Lake region, and southern California), *S. humifusa* (to Maine and Oregon); *Ranunculus hyperboreus* (to western Newfoundland and southern Alberta); *R. Purshii* (to Nova Scotia and New Mexico and represented southward by endemic allies); *Barbarea orthoceras* (to Newfoundland, Gaspé, northern New Hampshire, and Arizona); *Castilleja pallida* (represented in eastern America only by var. *septentrionalis,* but present in western America and there further represented by a number of endemic species); *Pedicularis flammea* (to Gaspé and southern Alberta); *Campanula uniflora* (to Gaspé and Colorado); *Antennaria alpina* (to the Torngat Mts. and the mountains of British Columbia, and represented on the Torngats, the Long Range and the Shickshock Mts. in eastern America and in the whole cordilleran region from Alaska to southern California and Colorado by more than fifteen localized endemics); *Tanacetum bipinnatum* (to the Yukon and Mackenzie valleys, represented southward along the Pacific by two endemic species and eastward by *T. huronense,* with var. *terrae-novae* endemic to western Newfoundland); *Petasites frigida* (to the Canadian Rocky Mts. and represented on the Shickshock Mts. of Gaspé and in the cordilleran region by at least 4 endemic species) and *Arnica alpina* (south to the Torngat Mts. and Manitoba, with 7 endemic representatives on the Torngats, the Long Range and the Gaspé Peninsula and as many more in the Cordillera from Alaska to Colorado). From these illustrations it must be apparent that, although the American-Siberian types which occur in northernmost Europe have there remained stable in their characters, these types or their close allies in America have very largely migrated southward along the Cordillera or to the region about the Gulf of St. Lawrence, in the latter region becoming isolated by the Labrador or Wisconsin glaciation, and in these southern areas a large series of local endemics have had time to develop and themselves often to have reached apparent senility.

When, however, we compare the ranges in North America and in Europe of the plants which in eastern America reach their southern limits near the southern margin or even south of the area covered by the last glaciation, we find a surprising parallelism. These plants, although



Ranges of (66) *Artemisia borealis*; (67) *Lomatogonium rotatum*; (68) *Draba nivalis*.

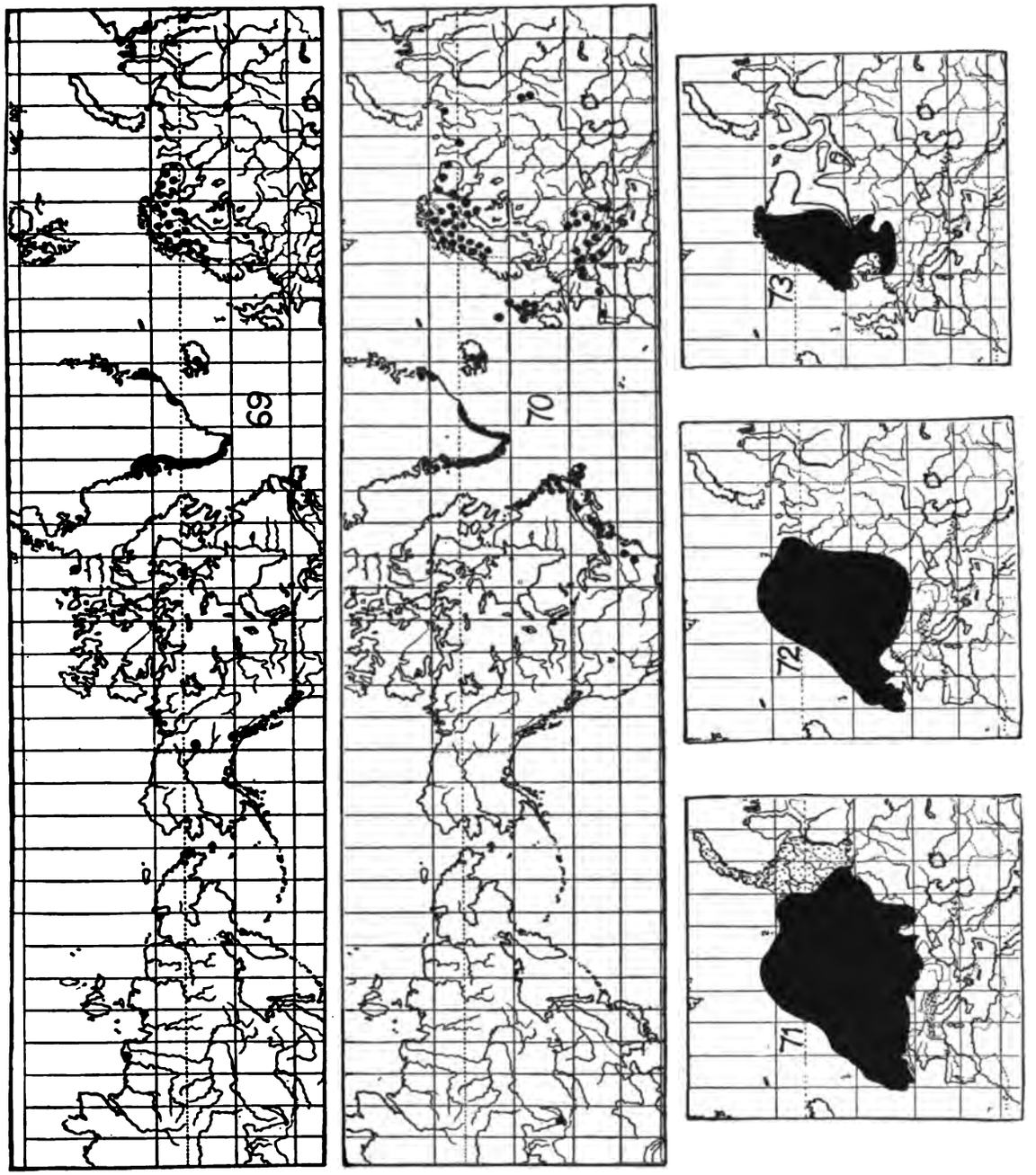
often as definitely circumpolar arctic types as the species just discussed, are found in Europe as well as in eastern America within or to the south of the area invaded by the last Pleistocene glaciers. The general southern extension both in Europe and America of these types is well shown by the range of *Juncus trifidus* (map 70). That this series of species has survived in central and southern Europe the encroachment of the last or fourth extension of the Baltic glacier is clear, and, although these plants are now occurring in Europe 20° south of the Arctic Circle, there, as in America, they have not set off any endemic species.

This strong contrast in the European distribution of the arctic types at once challenges attention; and if it be said that the American-Siberian types, which in Europe are restricted to the arctic or subarctic regions, are more boreal species than the others, we have only to point to *Lomatagonium rotatum* (map 67), which throughout its range is barely arctic, and to such plants of temperate eastern America as *Hierochloe odorata*, var. *fragrans*, in Europe known only in Norway, in America common at sea-level from Labrador to New Jersey (lat. 55°–39°); *Plantago juncoides*, var. *glauca* (*P. borealis*), in Europe known only in arctic Norway and Iceland, but common on the coast from Greenland and Labrador to Maine; and *Arenaria* (*Moehringia*) *lateriflora* (arctic Norway, Finland, arctic Russia, etc.) and *Coptis trifolia* (arctic and northern Russia), both reaching their northern (rather than southern) eastern American limits in southern Labrador. And if the general east-and-west course of the mountain ranges of central and southern Europe and the consequent "squeezing out" of plants between the Baltic glacier and the alpine glacial fields of southern Europe, be called into the discussion, it is to be noted that the arctic species which in eastern America occur near the southern limit of the Labrador (Wisconsin) sheet likewise occur today near the southern limit of the old Baltic sheet. If the latter species could withstand the crowding between the Baltic and the alpine ice-fields, surely the other series of arctic types should not have been obliterated if they also had reached central and southern Europe.

In considering the isolation southward in eastern America of these American-Siberian arctic types upon the areas which were not denuded by Pleistocene ice it was concluded that, in early Pleistocene these plants had spread across Labrador to Newfoundland and Gaspé and that later, with the development and great expansion of the Labrador and Newfoundland ice-sheets they were obliterated from all but the few areas where glacial activity was only local or comparatively weak. In view of this situation in eastern America it is, therefore, of peculiar interest to note that the remnant of the American-Siberian flora which persists in arctic Europe has its center and in case of many species (*Salix vestita, S. anglorum, Ranunculus Pallasii, Barbarea orthoceras, Eutrema Edwardsii, Braya purpurascens, Epilobium latifolium, Lomatogonium rotatum, Castilleja pallida, Chrysanthemum arcticum, Tanacetum bipinnatum, Artemisia borealis*, etc.) its only known stations in the area which was not invaded by the last two advances of the great glacial field of northern Europe. According to Geikie[1] during the maximum of Pleistocene glaciation (the second epoch) in Europe, "in the far north-east the ice-sheet terminated at the foot of the Timan Mountains. From these mountains, however, confluent glaciers flowed east and north-east into the valley of the Petschora, where they were joined by similar glaciers coming from the Northern Urals."[2] This condition is shown in map 71. In the third epoch the northeast extension of the ice stopped at the White Sea (map 72) while in the last epoch (map 73) the White Sea had tremendously

[1] James Geikie, *The Great Ice Age*, ed. 3, pl. ix, x, xi (1895). Dr. Ernst Antevs calls my attention to a later and more accurate series of maps of the continental glaciation of Europe, published in Osborn & Reeds, *Old and New Standards of Pleistocene Division in Relation to the Prehistory of Man in Europe*. Bull. Geol. Soc. Am. xxxiii. 411–490, especially fig. 3 (1922). The southern and eastern limits differ in some details but the conditions in arctic Russia and on the arctic coast of Kola Peninsula are shown nearly as in maps 71–73.

[2] Geikie, l.c. 439.



Ranges of (69) *Carex glacialis;* (70) *Juncus trifidus.* Maps, after Geikie, of (71) second glacial epoch of Europe, (72) third epoch, (73) fourth and last epoch (Great Baltic Glacier); dotted areas regions of alpine glaciers.

extended its borders but the Great Baltic Glacier left the eastern half of Lapland and a large portion of Finland undisturbed. When we compare with these maps of the Pleistocene in Europe the ranges of such plants as *Braya purpurascens* (map 58), *Epilobium latifolium* (map 64) *Eutrema Edwardsii* (map 65), *Artemisia borealis* (map 66), and *Lomatogonium rotatum* (map 67) and the many other species with similar ranges, it is apparent that they must have lingered in Europe to the northeast of the great Baltic ice-sheets and that in only a few cases, like *Draba nivalis* (map 68) and *Carex glacialis* (map 69) have they shown aggressive or pioneering vigor sufficient to extend their ranges slightly westward and southwestward into the region previously occupied by the Great Baltic Glacier. In North America where these or closely related species were able long before the development of the Labradorean ice-sheet to establish isolated southern centers on the Cordillera or about the Gulf of St. Lawrence, they have there often given rise to a large series of local offshoots; in Europe, where a southward migration was largely cut off either by the great glacial field itself or by the expanded White Sea, these arctic American-Siberian types, persisting only in the Arctic, have naturally shown no such tendency to produce localized endemics.

It has been shown that the species which are largely restricted in eastern America to the unglaciated areas of western Newfoundland and Gaspé or which there have endemic representatives are ancient types which in the past have set off many species which are now localized endemics of North America or of Asia. Only two cases of these more ancient American-Siberian arctic types having invaded central and southern Europe occur to the writer. These are *Saxifraga caespitosa* and *Antennaria carpathica;* and it is, therefore, noteworthy that Engler & Irmisch recognize *Saxifraga caespitosa* as a "typus polymorphus" with no less than 17 geographic segregates; while in North America alone *Antennaria carpathica* is represented by 12 isolated endemics.

That the restriction of the majority of American-Siberian types to unglaciated or but slightly glaciated areas in temperate eastern America and in arctic Europe is not in any way due to their *preference* for unglaciated soils is perfectly clear. On the Canadian Cordillera where the first Pleistocene continental ice-sheet of America developed and on the west side of Hudson Bay where the second glacial-field had its center, they have made themselves at home. Similarly in Greenland, a country which they apparently entered by way of Ellesmereland and the unglaciated northwestern section, they have largely spread along the coastal rim from which the Pleistocene ice has withdrawn.[1] The peculiar restrictions of these plants in eastern America and in Europe seem, then, to be due to their comparative antiquity. They were aggressive and ready for pioneering and wide dispersal prior to the development of the Labrador ice-sheet, but the expansion of the Labrador glacier obliterated much of their eastern American area and there they now have a disrupted range. But during the period when they were most adaptable and were spreading over North America and Asia they were mostly withheld from effective southern migrations in Europe through the occupation of the Scandinavian region successively by each of the four great glacial fields of Europe.

[1] If it ever completely covered the coastal rim. See p. 329.

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